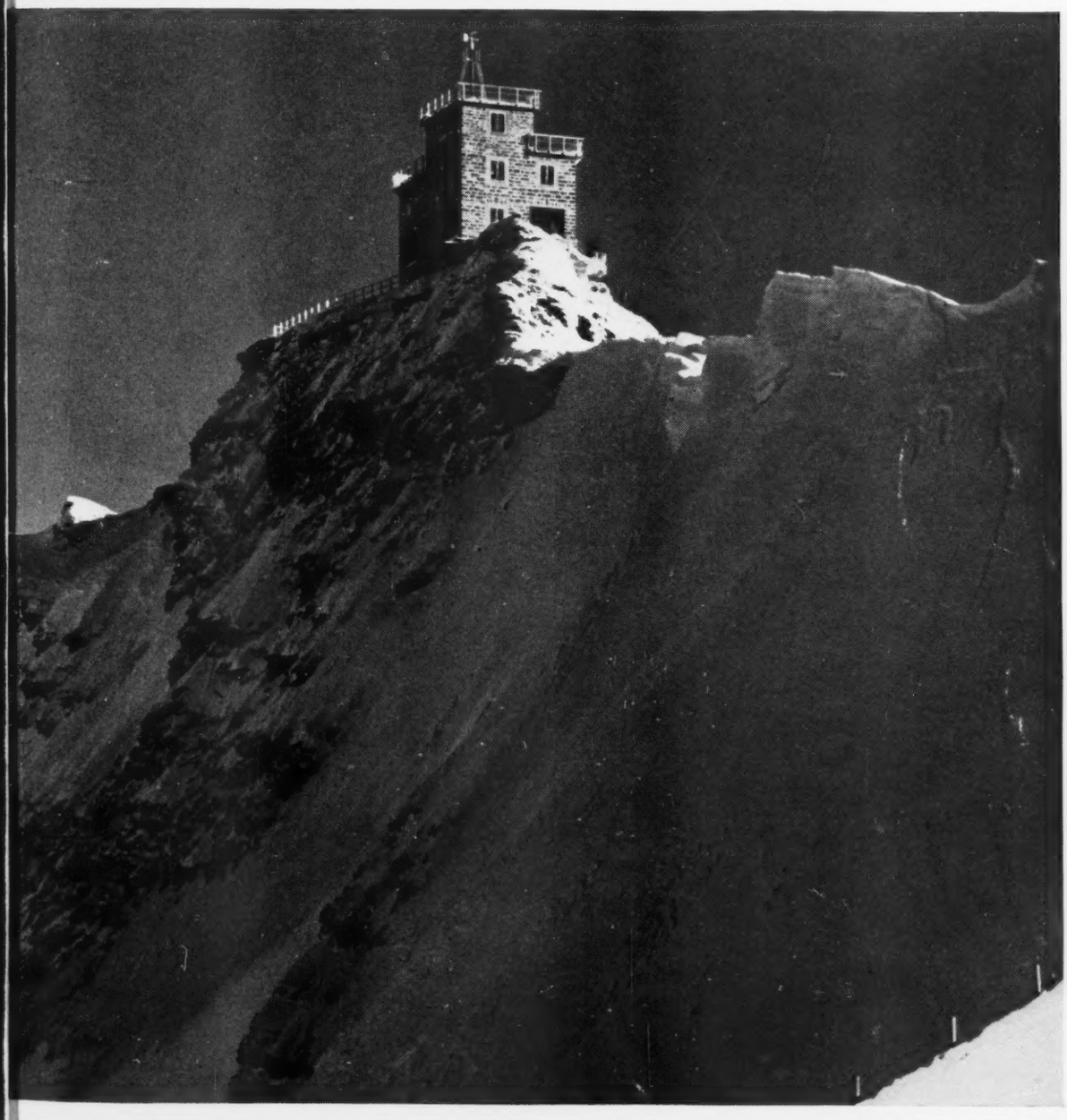
Compressed Air Magazine

JANUARY 1946



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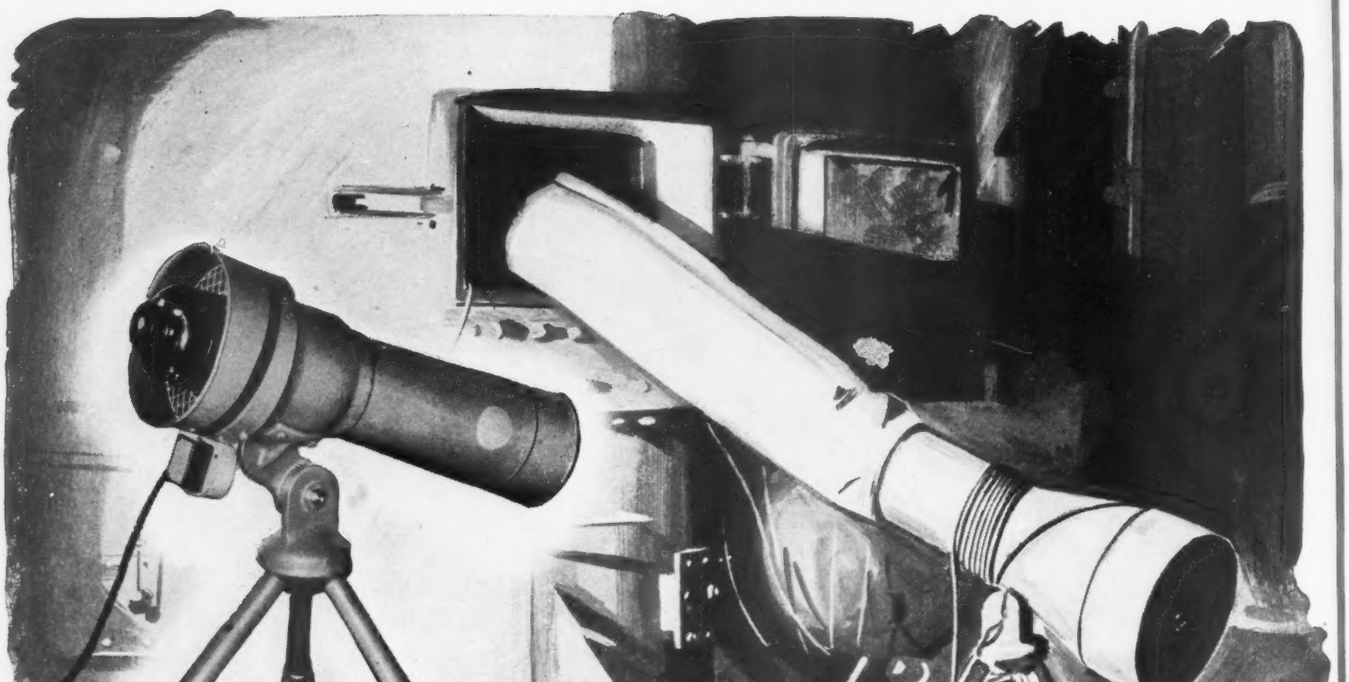
VOLUME 51 • NUMBER 1 NEW YORK • LONDON



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ON THE COVER

IN 1931, an international group of scientific organizations, aided by the Jungfrau Railway Company, established in Switzerland a meteorological observatory designed to gather data of value to astronomers, weather bureaus, physicians, and specialists in aerodynamics. The main building is on the sheltered southern slope of Jungfrauloch Mountain. The building pictured on our cover, and which was added later, is on the summit, 11,722 feet above sea level. The two structures are connected by an elevator in the interior of the mountain. The photograph was made by R. Schudel and is published through the courtesy of the Jungfrau Railway.

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IN THIS ISSUE

ONE of the interesting features of the article on the Cleveland Quarries that starts on the following page is the description and pictures of two air compressors that have been in service since 1903. Although outmoded by present standards, they still carry the load and have compiled a remarkable record of dependability and economy of maintenance.

•

WITH the war over, construction jobs for civilian purposes are being resumed. The one covered by the article that begins on page 6 is a bridge across the Passaic River at Newark, N. J., that will speed the trip of many commuters who travel to and from New York in automobiles. The placing of the piers involved the use of compressed-air caissons, affording work for the highly skilled sandhogs who took an enforced vacation from their regular calling during the war period.

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PERU is engaged in an ambitious construction program that is intended to pave the way for various industrial enterprises. A resumé of these activities (page 12) is presented by an American engineer who was intimately connected with planning them.

•

AS SOON as strategic islands in the Pacific Ocean were wrested from Japanese control, they became beehives of construction activity to make them of maximum service in furthering the advance on Tokyo. In this work, air compressors and rock drills were indispensable aids to our soldier-engineers. How Guam island was quickly transformed into a strong military base is told by a man who was there. See page 15.

Compressed Air Magazine

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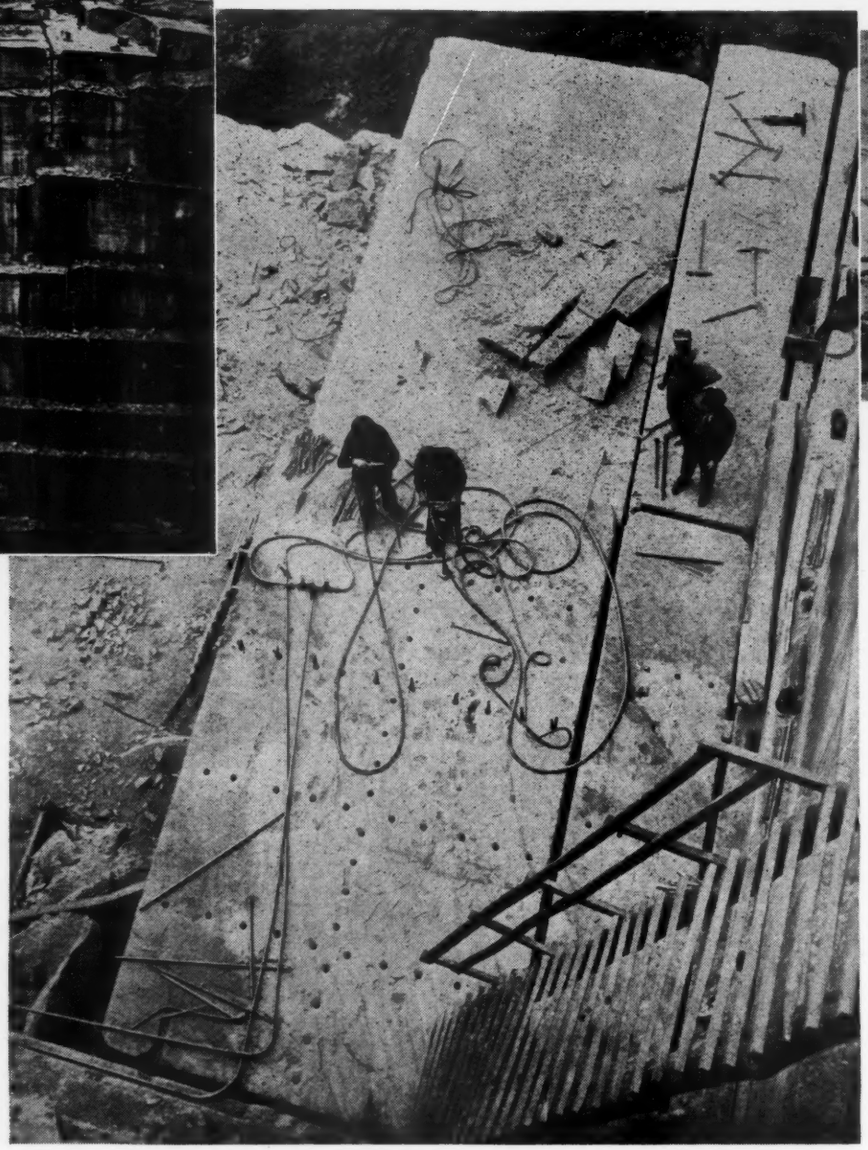
43-Year-Old Air Compressors Still Serve Quarries

Photos from Compressed Air Institute

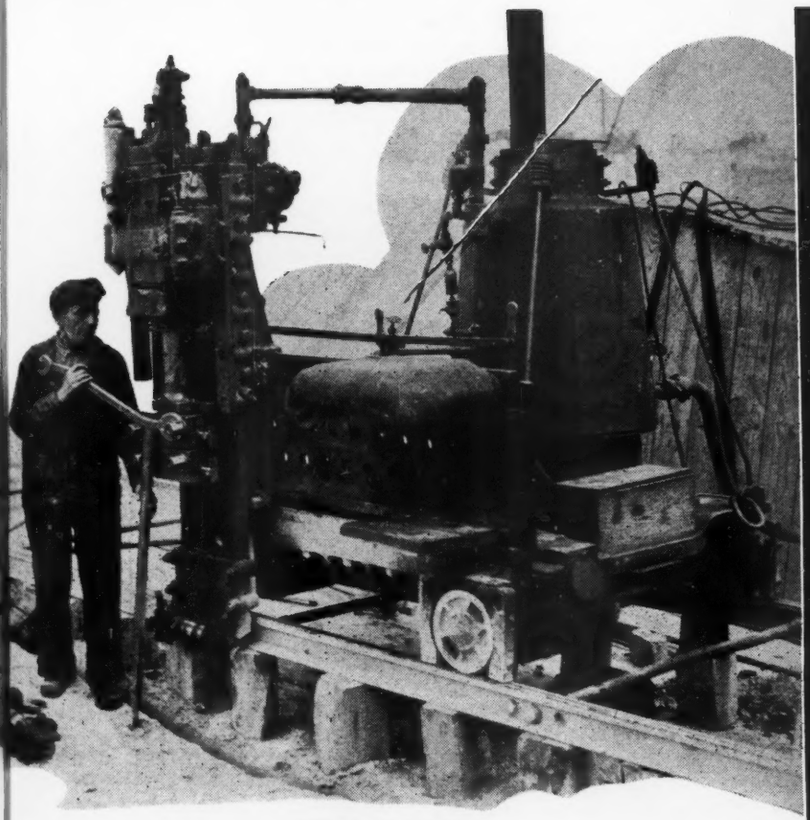


FROM five deep quarries, carved in the earth at the edge of the hamlet of South Amherst, Ohio, during the past half-century, has come sandstone to provide curbing for many city streets, grindstones for farms and industry, exterior stone for monumental buildings, and refractories for lining furnaces. Sandstone for the two first-mentioned uses was once shipped from this area to all parts of the country, but more recently business has fallen off because of the competition offered by concrete and artificial abrasive stones. The quarries have continued to operate, however, and during the war period even attained a measure of their former prosperity when the sharp increase in steel-making facilities quickened the demand for heat-resistant linings for various types of melting furnaces.

The latest issue of *Minerals Yearbook*, published by the U. S. Bureau of Mines, credits Ohio with 44 percent, by value, of the nation's sandstone production in 1942. It adds that "the largest quarries are in the Amherst area in the northern part of the state." The operations under discussion are conducted by the Cleveland Quarries Company, and the workings are claimed to be the largest in existence for the production of sandstone. They are very deep and spacious, so much so in fact that men laboring at the bottom of one of them appear as specks to an observer peering over the edge at surface level.

Throughout the entire period since the beginning of the century, during which millions of cubic feet of stone have been cut out and hoisted slab by slab, air compressors have been the principal source of power applied to the task. Two venerable machines that were set up in 1903 have carried the air load ever since that time and are in good service condition today. Until 1929, both of them were run whenever the quarries were working, and during the first twelve years of their service they operated 24 hours a day for days at a time. By making minor changes in 1929, it was possible to increase their output so that one machine could carry the load. This permitted alternating them in service, and that is still being done. The quarries are now working ten hours daily.

The air is compressed to approximately 95 pounds pressure and is distributed



GENERAL VIEWS

A section of one of the quarries from which air-powered equipment has cut millions of tons of stone is shown at the extreme left. Work is underway on the floor and on the ledge at the right, where a channeling machine is visible. The downward view (left) shows a workman putting down one of a series of holes which will be used to break the larger block into smaller ones by the plug-and-feather method. The man at the left is inserting an air pipe in a hole to blow it clear of cuttings. The various large key blocks on which the men are standing were cut loose from the mother bed by track channelers, one of which is shown above. The workman is about to insert a cutting bar in the chuck of its piston-type rock drill. As built, channeling machines included a boiler for generating operating steam, but at these quarries, as in most other places where they are still used, they have been run with air for many years. The vessel on the right of the machine is an air heater. An 850-pound piece of sandstone curbing is shown at the right being lifted by an air-cylinder hoist for loading it on a flat car. The operation is handled by one man

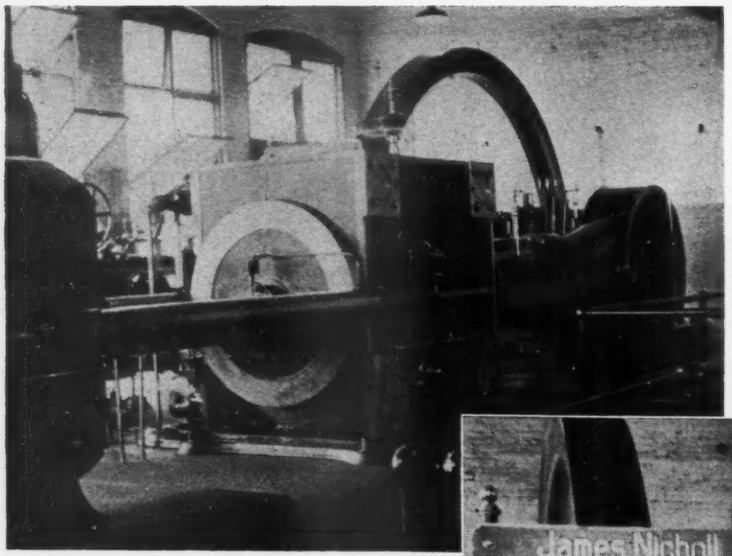
throughout the quarry area by 16 miles of piping. These lines are so tight and so well maintained that there is virtually no loss, the pressure between the plant and the most distant point in the system, about a mile away, varying only 2 or 3 pounds. In the quarries, compressed air is used chiefly for operating channeling machines, rock drills, and pumps. As an accompanying picture shows, the channeling machines make the vertical cuts to detach large blocks or slabs of stone from the continuous beds. The big blocks are then subdivided in place into smaller ones by putting down rows of holes with hand-held rock drills and by breaking the stone along these lines by the plug-and-feather method. The plugs are driven with air-operated hammers, but before this is done the holes are blown out with compressed air.

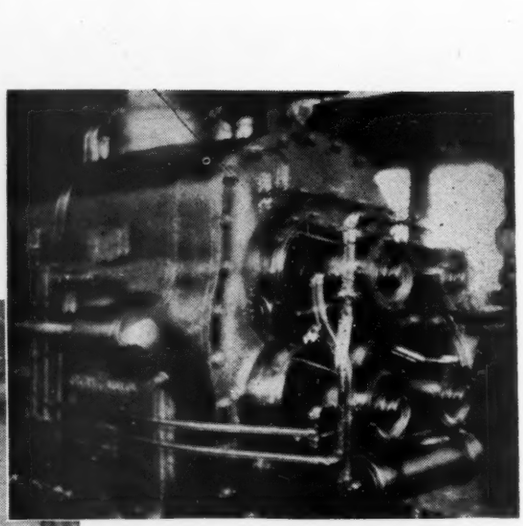
Approximately 30 pumps are employed, principally for dewatering the quarry sumps and keeping the working levels dry. Although of the conventional steam-driven type, they are operated with compressed air because steam losses through condensation in the extensive distribution system that is required would be excessive. Another use of air is in putting down prospecting holes to test and sample the underlying beds to determine their suitability for future production. These holes are drilled with core drills that are usually air operated.

The compressors discharge into a large outdoor receiver where the air is heated prior to distribution. At the quarries some of it is again heated, raising its temperature to 275°F. Each channeling machine has an air heater attached to it, and the air supply for these machines is heated the year round. Air for the other equipment is heated during the colder months only. Heating expands the air and minimizes condensation of moisture in the tools, thereby preventing freezing and improving lubrication.

Aside from the important part it plays in the actual quarrying of the stone, compressed air serves widely in performing the accessory work. In the curbing yard and planing department, some 30 air-cylinder hoists handle the heavy blocks of stone. They are preferred to other equipment of this type because they permit of extremely close and precise control during loading operations and the cost of maintaining them is relatively low. Comparatively recently it was found that another piece of air equipment could be utilized to advantage in this department in place of a drill press for putting holes in sandstone blocks sold for lining cupolas. Someone suggested that perhaps greater speed and equal accuracy could be obtained by means of an ordinary Jackhamer rock drill mounted on a stand. Upon being tried out, the set-up proved so satisfactory that it was adopted for that work. In this department, also, small plug drills of ⅞ and 1-inch sizes serve extensively for cutting firestones and for similar operations.

A completely equipped machine shop is responsible for the repair and maintenance of mechanical equipment and builds special quarrying machines. At times it also does work for neighboring quarries.





IN THE COMPRESSOR ROOM

The walls of the room are too close to the machines to permit photographing a complete unit, which measures 18½ x 46½ feet. A partial view of the low-pressure side of one compressor appears at the upper left. Part of the air cylinder is at the left, the steam cylinder is in the center, and the flywheel is beyond it. The picture above shows the rear portion of one of the air cylinders as it appeared before its original valves were changed. In the cluster of extensions at the right may be seen four small air cylinders that actuated the valves. The piping carried air to them. When these compressors were installed it was customary in some plants to name outstanding machines for men in the organization. Shown at the left is the gauge board for the compressors and over it the name of James Nicholl, who was one of the early officials of the company.

Here, too, compressed air is helpful by blowing cuttings away from machine tools, removing grease and dirt from equipment brought in for attention, and by doing other typical machine-shop jobs. Adjoining the shop is an equipment-testing room where repaired air-operated tools are checked under actual running conditions before being sent back to work. In the blacksmith shop, where drill steels and various other cutting tools used in quarrying and dressing the stone are regularly resharpened, compressed air is used to aid combustion in the oil-fired heating furnace and also to operate the drill-steel sharpener.

The history of the two old compressors is interesting and indicates that this class of machinery is very durable when given reasonable care. It is not often that machines of their age are kept in active service, because most users acquire new equipment from time to time to take advantage of improvements in design and construction. But in some cases, of which this one is a striking example, the older units meet the needs satisfactorily and are consequently retained long after their normal operating period has expired.

The compressors, which are identical, are of the 2-stage, duplex-type and are driven by compound steam cylinders. Each has an output of approximately 5000 cfm. They are massive machines and take up several times the floor space occupied by modern compressors of the same capacity. The air cylinders and a large flywheel are at opposite ends, with the steam cylinders near the middle. The units were sold by the Ingersoll-Sergeant Drill Company, one of the predecessors of Ingersoll-Rand Company, and are designated as "Class C," the "C" standing for Corliss steam engine, the type used as drivers. The low-pressure steam cylinder of each machine is 44 inches in diameter, the high-pressure cylinder 20 inches, and both have a 48-inch stroke. The low- and high-pressure air cylinders are 39¼ and 24¼ inches in diameter, respectively, and have a 48-inch stroke.

In their day, these compressors ranked among the finest machinery made. A catalogue published in 1906 called them the "thoroughbreds of the compressor class," and "high-duty machines representing the extreme of the designer's art." It also recorded that they held the world's record for efficiency. They were not advertised or stocked in standard sizes, being built to order to meet the user's needs and in accordance with the steam-producing plant on the premises or planned. All were large-capacity units built for heavy and continuous service, and some of 60-inch stroke were produced.

Old records of the manufacturing concern show that the air cylinders and accessory gear were shipped from the factory at Easton, Pa., on October 1, 1903, to the Cleveland Stone Company, of which the present Cleveland Quarries Company is the successor. The engine end was made by a separate concern, the C. & G. Cooper Company of Mt. Vernon, Ohio. That was the usual custom in those days, the two component sections being shipped from the plants where they were built and then assembled where the complete machine was to operate.

As delivered, the air cylinders were equipped with air-moved valves. Movement of the piston by this design was transmitted through mechanical connections to a small air cylinder mounted on one side of the compressor cylinder. The air cylinder, in turn, transmitted pneumatic impulses through piping to other cylinders, of which there was one for each inlet valve and each discharge valve. The latter cylinders were mounted on the fronthead and backhead of the compressor cylinders and served, by means of pistons, to open and close the valves. This arrangement was subsequently changed.

From Samuel Wragg, chief engineer of The Cleveland Quarries Company who has been in charge of the compressor plant since 1925, we have obtained the history of the machines since they went into operation. "The plant," says Mr. Wragg, "cost $97,000 and was one of the most

modern of its kind when it was put in. It consisted of three 250-hp. Stirling boilers to which two more 250-hp. units were later added, complete with feed-water heater and live-steam purifier, pumps, controls, etc., plus the two air compressors. The compressors ran at 75 rpm., and at the time I assumed charge of the plant they had been operating for 23 years with the air-thrown valves. These valves had given good service, but were expensive to maintain in good working order, the cost per year for regrinding and replacements ranging from $1100 to $1500.

"In 1928 we started revamping the plant and the first thing on the program was the improvement of the air-compressor valves. Inquiries revealed that Ingersoll-Rand plate valves could be installed on the 25-year-old machines by simply removing the complete assembly of heads and valves, and bolting on new ones. This was done, at a cost of less than $6000, which did not equal the expense of five years' maintenance of the old valves. The new valves were added in the forepart of 1929, and we have since spent nothing on them. We still have the spare parts that we ordered when we made the change. After five years of operation, we removed and inspected the valves on one of the compressors and found them in good condition. Consequently, we did not remove the valves from the other machine, and they have not been taken out yet.

"We had been told before the new valves were installed that they would increase our air output by around 10 percent. We wanted to run a test to see if this was true, but we had no instruments to record the volume of air compressed, so we had to figure out a way of getting the answer without them. Before removing the old valves, we overhauled them, and then we kept a record each morning for ten days of the number of revolutions of the compressors required to bring the pressure in the air lines and receivers up to 80 pounds. This was found to average 696 revolutions. We then put the new valves in and made a similar count for ten days. The average was then found to be 632 revolutions, or 64 less than previously. The indicated gain in efficiency was slightly more than 9 percent.

"At the time the new valves were put in, we rebored the steam cylinders, rebabbited the crank pin and main bearings, and installed new crank pins and wrist pins, all of which still remain in good condition. We noted smoother operation of the engines immediately, and that has continued.

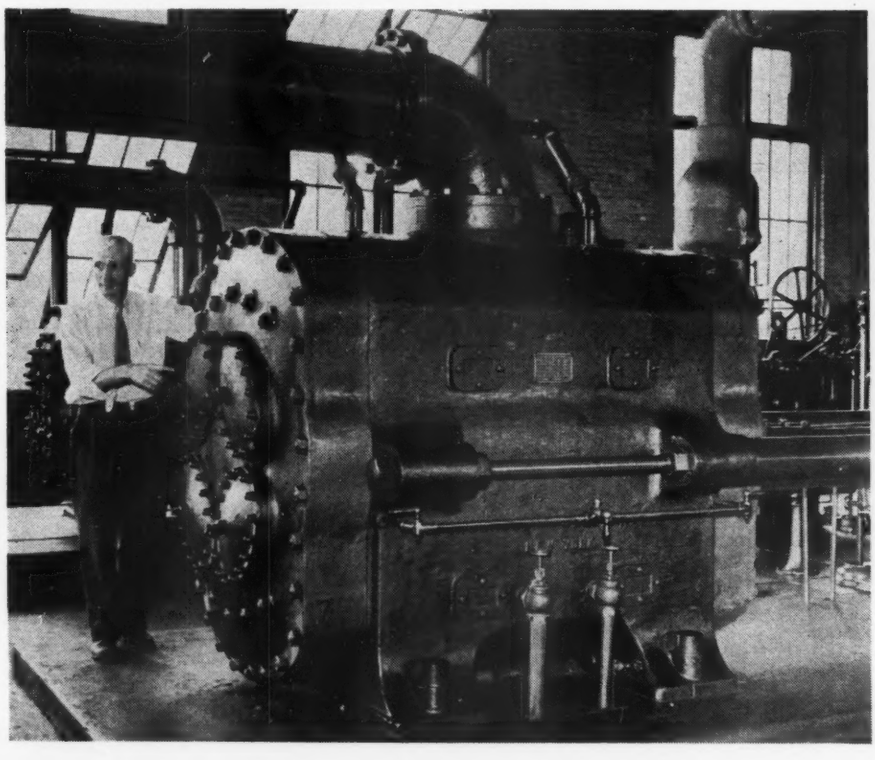
"After running the test, we brought up the question of increasing the speed of the compressors from 75 to 90 rpm., and were told we could probably do this, but would have to watch for valve breakage. We speeded up the machines without any valve trouble developing and this enabled us to hold the load and carry the peaks with one machine operating, whereas we had previously had to use both of them. The greater speed probably lowered the compression efficiency, but our coal and maintenance bills were reduced and we also found it possible to maintain a steadier pressure in the air lines.

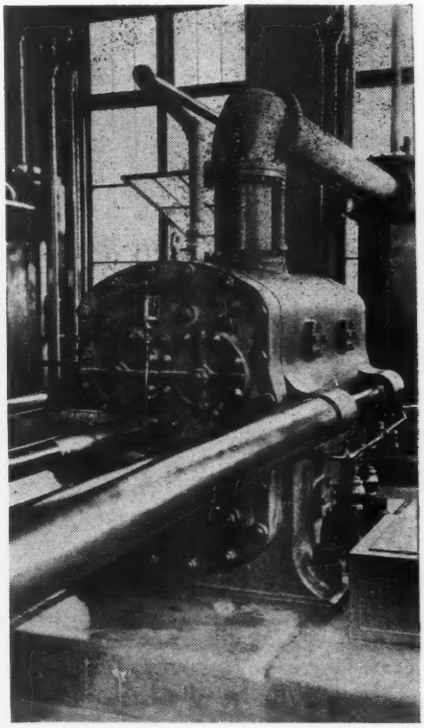
"The change of heads and valves considerably reduced the lubricating oil consumption of the air cylinders. We had 18 lubricators on each cylinder with the old valves, whereas now we have but one.

"The air cylinders still have the original pistons. In 1928 new rings were put on them. We checked the air cylinders in 1940 and found them to be 0.023 to 0.025 inch oversize. The wear has been uniform throughout, the centers being out of round only 0.005 inch less than the ends. The largest diameters are sideways and not vertical. As the pistons have no tail rods, they seem to float in the cylinders, with a slight side thrust at the end of each stroke.

"I can find no record of cleaning any carbon from the cylinders and I have never removed any from discharge chambers or valves. Our boiler plant now consists of one 471-hp. and one 512-hp. unit. The original compressors have worn out one set of boilers and have ten years on the new set."

During the era when these compressors were purchased, it was not unusual to name important machines for persons who had been or were then prominent in the establishments concerned. Following out this custom, there was erected above the compressor gauge board a brass plate bearing the name of James Nicholl, and it still remains there. Mr. Nicholl was a pioneer quarryman and his son, James Nicholl, Jr., was general manager of the quarries when the compressors were set up.





COMPRESSOR CYLINDERS

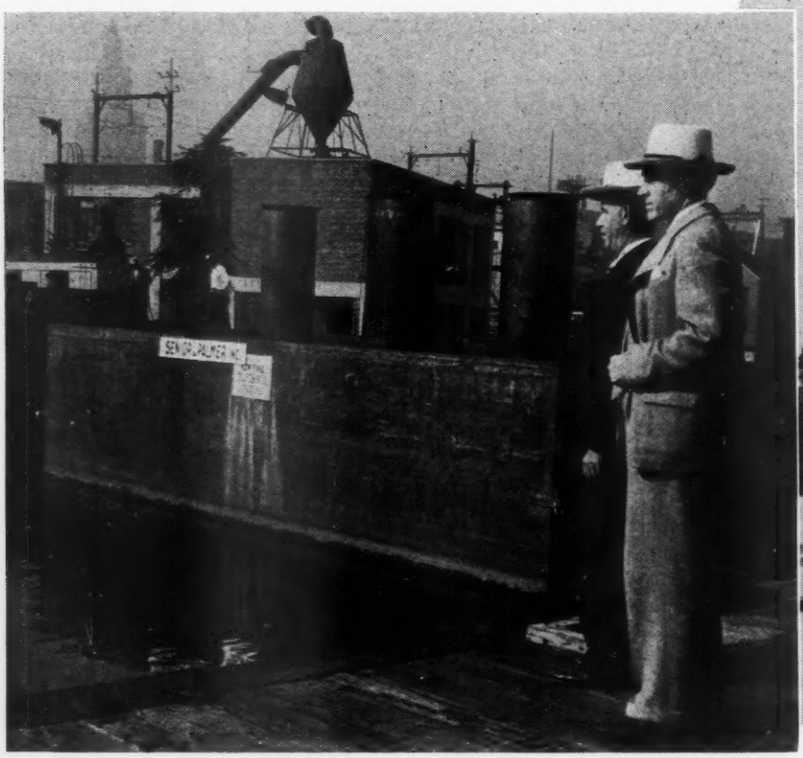
Chief Engineer Samuel Wragg (left) standing beside the high-pressure cylinder of one of the compressors and pointing to the plate valves that were installed in 1929 to replace the original air-thrown valves. The other picture shows the fronthead end of the low-pressure cylinder of one of the machines.

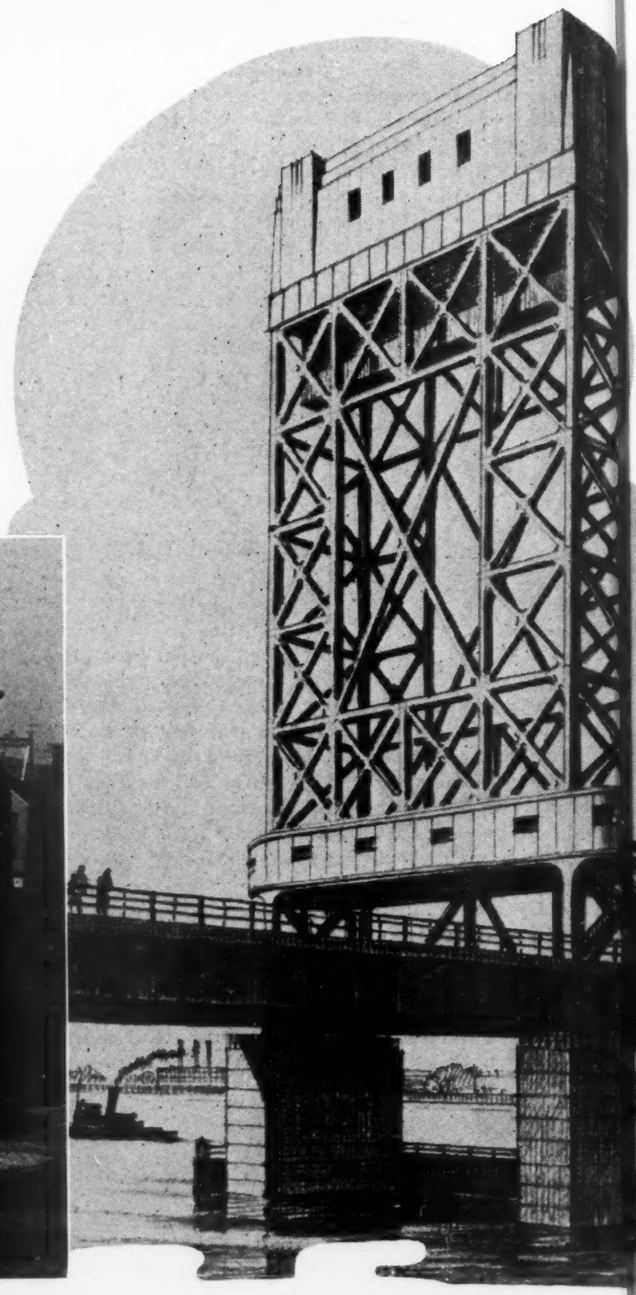
A New Bridge at Newark

S. G. Roberts

BRIDGE SITE AND ARTIST'S SKETCH

In the center is an architectural perspective of the bridge as it will appear when completed. At its right and below it are two views of the area where piers for the new structure have been sunk on both sides of the Passaic River. In deference to public interest, the contractor provided a vantage point for viewing the work and erected a sign directing the way to it that is visible in one of these pictures. One of the two caissons sunk on the Newark side is shown below as it appeared just after being delivered by the manufacturer. Viewing it are (right) Spencer Miller, Jr., New Jersey State Highway Commissioner, and Morris Goodkind, the commission's bridge engineer.





ONE more river crossing, and a much needed one at that, is to span the Passaic River a few hundred feet upstream from the Delaware, Lackawanna & Western Railroad's swing bridge. The foundation piers for the new structure—the William A. Stickel Memorial Bridge, have been recently completed by Senior & Palmer, Inc., for the New Jersey State Highway Department.

The memorial span is intended to supersede the relatively old and much-used Bridge Street Bridge a short distance downstream which joins Newark with Harrison and is tributary to one of the busiest sections of Newark—New Jersey's largest city and a nationally known industrial center. The Bridge Street crossing is an essential link in a route that runs eastward to Jersey City and thence connects by subaqueous tunnels or ferries with New York City. It is a low swing structure that has to be opened for all but the smallest craft on the Passaic River, and one does not have to be especially imaginative to envision what repeated opening does to interrupt vehicular movements, particularly at the peak hours when travel is dense.

The building of the Stickel Memorial Bridge is in response to increasing demand for ampler accommodations for traffic bound east and west across the Passaic. The necessity for such improvements was recently explained by the New Jersey State Highway Commissioner, Spencer Miller, Jr., as follows: "The State is at a point where it has to catch up on a 15-year lag in highway development. We knew what we needed in 1930, but the depression came along and held us up. Just as we got ready for action again, the war came along and put a stop to construction." In addition, Mr. Miller emphasized the situation by pointing out that North Jersey has been losing population in the same ratio that Westchester and Long Island, N. Y., have been gaining, and mainly because New Jersey has no adequate highway system to take people quickly to urban centers.

The new crossing has been conceived to take care of traffic between Newark and the populous outlying suburban sections of Essex County; and to do so it will connect with a splendid, projected freeway that will run above grade or be depressed, as may be required, to permit through automotive traffic to speed along without interfering with local cross traffic. The planners of both the bridge and the freeway have in mind the inevitably large increase in power-driven vehicles and the

greater speeds at which they will be able to travel in the future.

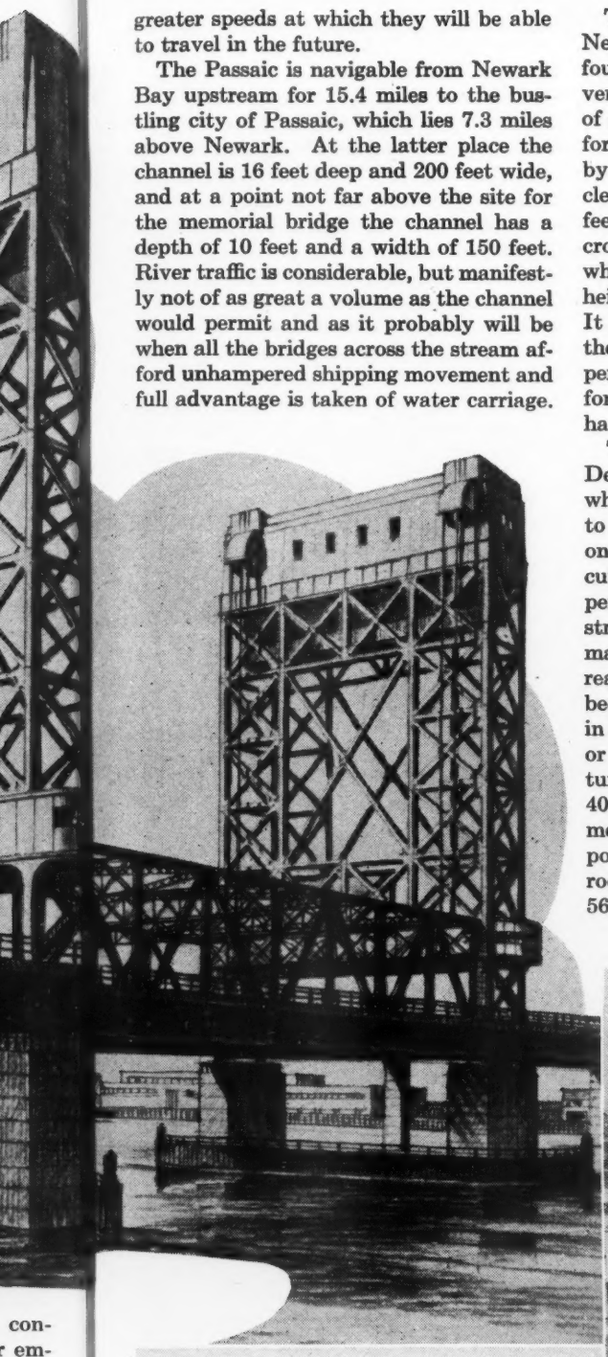
The Passaic is navigable from Newark Bay upstream for 15.4 miles to the bustling city of Passaic, which lies 7.3 miles above Newark. At the latter place the channel is 16 feet deep and 200 feet wide, and at a point not far above the site for the memorial bridge the channel has a depth of 10 feet and a width of 150 feet. River traffic is considerable, but manifestly not of as great a volume as the channel would permit and as it probably will be when all the bridges across the stream afford unhampered shipping movement and full advantage is taken of water carriage.

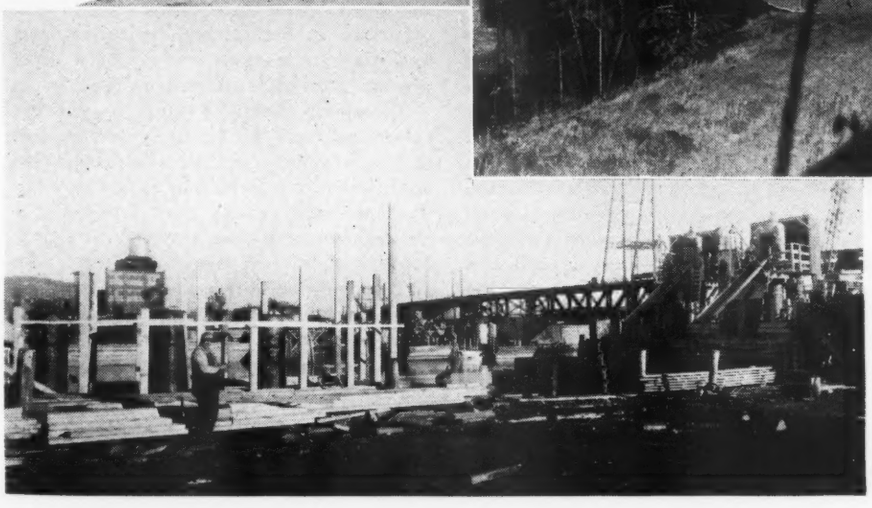
The superstructure of this latest of Newark's bridges will be supported by four masonry piers and will be of the vertical lift type. It will have a clear span of 200 feet between opposing pier fenders for the passage of vessels, as prescribed by the U. S. War Department. Vertical clearance at mean high water will be 35 feet when the lift span is down and the crossing is open to vehicles, and 135 feet when the span is raised to its maximum height to permit a masted craft to pass. It is estimated that with the span closed the clearance will ordinarily be ample 85 percent of the time to take care of ships for which the Bridge Street Bridge now has to be swung open.

The foundation work was completed December 1945 by Senior & Palmer, Inc., who used the pneumatic-caisson method to carry and key the masonry piers—two on each side of the river—to bedrock. The cutting edges of the four caissons had to penetrate an overburden of silty sand, a stratum of clay and boulders, and a formation of seamy shale before finally reaching solid rock, where footings have been established in excavations ranging in depth from 3 to 4 feet. On the Newark or west side of the Passaic, the two structures were brought to rest at a depth of 40 feet below the surface of the stream at mean high tide, while those on the opposite shore, because of the dip of the bedrock toward the east, have their footings 56 feet below water level.

The steelwork for the caissons was fabricated at the plant of the New York Engineering Company, Yonkers, N. Y., and towed down the Hudson River to Newark Bay and thence up the Passaic to Newark, where it was delivered early last September. Each of the rectangular, watertight boxes is 41.5 feet long and 19.5 feet wide, with the short side parallel with the bulkhead line. The bottom edge was reinforced to provide the cutting edge that had to withstand rough treatment as the structure forced its way downward to bedrock through the obstructing materials. The working chamber, which was open at the bottom, had a height of 6 feet above the cutting edge, and its sides and ends sloped upward and inward to the steel roof of the chamber within which the sandhogs had to do their excavating under increasing air pressure to force the water outward as the caisson gradually settled.

Prior to the arrival of the caissons their anchorages had been superficially leveled by the Schultz Dredging Corporation and piles had been driven to steady the structures and to hold them in their prescribed positions during the sinking operations. Leading down through each caisson and spaced at equidistant points along the longitudinal center line were three towering tubular shafts of steel. The central one, when fully equipped, had a man lock on top large enough to hold fifteen persons. This served as a passageway and





BOTTOM OF A CAISSON

A picture made in the working chamber after the caisson had been landed on bedrock. The floor is being cleaned thoroughly preparatory to pouring the first concrete.

was provided with a steel ladder by which the workers could reach the working chamber from the surface or ascend from it while that chamber was under air pressure. The two neighboring shafts, also fitted with locks but of a different type, permitted the raising and lowering of the buckets by which the excavated material could be brought to the surface for disposal without disturbing the air pressure in the working chamber. The muck was either dumped on shore or loaded into barges by chute or crawler cranes.

The steelwork of the caissons was carried about 8 feet above the roofs of the working chambers to support the boxlike timber structures or surmounting walls that were progressively extended upward as the caissons sank to keep their tops at a safe height above the surface of the river. Internally the timber sheeting was reinforced by heavy vertical posts as well as horizontal and diagonal bracing, all of timber. The surmounting walls likewise served as forms in which to place the concrete that was to give the caissons the necessary dead weight to carry them down and eventually to build up the massive piers upon which to set the towers that will guide and sustain the lift span. Concrete was poured, step by step, until the piers reached a final height of 33.5 feet above mean high-water stage.

Work on the substructure of the Stickel Memorial Bridge was under the personal supervision of James F. Armstrong, vice-president of Senior & Palmer, Inc., to whom we are indebted for the particulars regarding the present contract. Caisson sinking started the last week of September, 1945, and was carried on continuously, day and night, until it was concluded on October 30 of that year. Concrete was placed with 1-yard dump buckets in lifts varying from 3 to 5 feet in thickness, and wherever necessary the material was compacted by pneumatic vibrators driven by Multi-Vane air motors. When each caisson was firmly seated on bedrock, then its working chamber was filled with concrete. That material was dropped from the tops of the muck-lock shafts so that the impact of the fall would be sufficient to compact it during the final pouring stages. The concrete was transit-mixed and delivered by trucks from a nearby commercial plant.

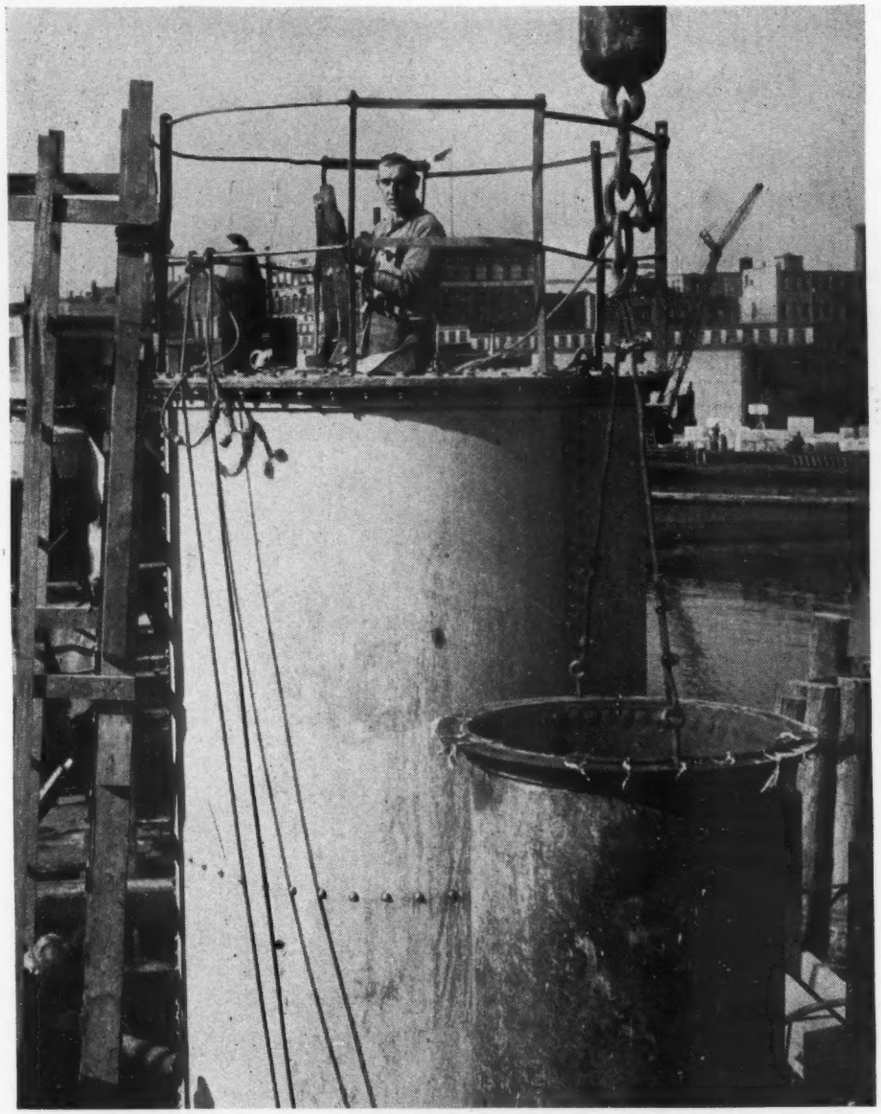
During the sinking of the caissons, and especially while working downward through the strata of clay and boulders and the seamy shale, the contractor used both No. 75 I-R pneumatic diggers and L-54 paving breakers, the latter equipped with chisel-edge steels. Clearing of the final seatings in sound bedrock was done with Jackhamers of different sizes. Seepage into the working chambers and clearing away pools of fluid mud and water were taken care of by air-operated sump pumps. When engaged in cutting, preparing, and assembling the timber for the superstructures of the caissons, woodborers of the Multi-Vane type proved of great service.

The extensive use of compressed air in excavating for the piers, in checking the inflow of water into the caissons, and otherwise in facilitating the subaqueous and other operations, called for a compressor plant of considerable capacity. It was made up of eight machines of varying types and sizes with a combined output of around 5000 cfm. All were carried on board a barge moored first at the Newark dockside, with supply lines delivering to the caissons, and then alongside the East Newark shore. Subsequently, when less air was needed it was supplied by two large portable compressors at the opposite stations.

The compressor plant was an interesting one because of the contrasting types in use. This was emphasized by a PO oil-engine-driven unit, with a capacity of 1500 cfm., that was bought by Senior & Palmer back in 1929. Mr. Armstrong ex-

pressed his approval of that pioneer machine by saying, "and it is still going strong." A 500-cfm. diesel portable of the latest pattern, likewise an Ingersoll-Rand machine, offered a striking contrast. On the compressor barge there was also a small Type 30 to furnish starting air for the diesel-driven units. Further, there were accommodations aboard for the sandhogs in the form of showers, dressing rooms, and a coffee shop. The latter was necessary because pressure workers, according to medical authorities, have to have hot coffee after coming out of the working chamber. At the maximum depth of 60 feet that was reached in preparing the footings for the East Newark caissons the men were under a pressure of approximately 26 pounds per square inch.

The piers are set close to the established bulkhead lines that flank the waterway at the bridge site. There are two on each side, spaced 81 feet 4 inches apart center to center, and the distance between the opposing twin structures with their protecting fenders in place is 252 feet on centers. To safeguard the concrete piers from injury either by vessels out of control or by the damaging action of floating ice when the river is running swiftly at flood periods they are faced from a level of 5.5 feet below to 6 feet above mean high water with granite blocks obtained from the Deer Island Granite Company. The contract cost for the substructures was $441,323.



MANWAY AND MUCK SHAFT

The larger cylinder is the man lock of one of the caissons that has been sunk to bedrock. This lock was large enough to accommodate fifteen sandhogs at a time. From it, a ladder led downward to the working chamber, which is pictured on the preceding page. The smaller cylinder is the upper part of one of the two twin muck shafts. The lock has been removed from it in making ready to use it for placing concrete in the working chamber below during the final stages of the concrete pouring. The dropping of the concrete from this height served to compact it adequately.

The towers of the Stickel Memorial Bridge will rise to a maximum height of 174 feet above the tops of the sustaining piers, or 207.5 feet above the Passaic at mean high water. They will carry the vertical-lift span that will be raised fully 100 feet above its normal position when down and resting on the concrete piers. The lift span will be supported by trusses 81 feet 4 inches apart on centers and, like the adjoining shore approaches, will have a total width of 96.4 feet and a length from center to center of the shoes of 222 feet.

The crossing will have two roadways, each 36 feet wide, with a central 4-foot mall, and there will be a 6-foot walkway on each side. Manifestly, each roadway will be wide enough for three lines of vehicles traveling in one direction and will be capable of handling much denser traffic than the existing Bridge Street Bridge which it will supplant. Just how much of a relief the new structure will provide for the present shipping bottleneck at the Bridge Street crossing, which is a short way downstream, is indicated by the fact that another span, a few hundred yards upstream, was opened 4646 times for river craft during 1944. And the latter is actually operated less frequently in the course of a year than is the Bridge Street Bridge. At this time, some interesting structural and mechanical features must be omitted from this treatment of the new span, which has been planned as a connection for the projected freeway from Newark to West Orange now designated as Route 25-A.

Senior & Palmer, Inc., which did the foundation sinking, has been in business since 1929 and in the meantime has been successfully engaged in work of that kind for railroads, industrial plants, and public authorities in various parts of the country. During the recent war years it also had important jobs to do for the Government. In a booklet issued by the contractor, the following tribute is paid to the workers who so quickly built the foundation piers: "Many of these men have been on other jobs accomplished by Senior & Palmer, Inc., and the company expresses its appreciation of their skill and loyalty in carrying through the completion of this and other important projects." As the same source points out: "It is an old joke that doctors bury their failures—the sandhogs are different—they bury their successes."

Maj. H. R. Gabriel is the resident engineer on the project for the New Jersey State Highway Department. The piers were designed by the Bridge Division of the New Jersey State Highway Department under the direction of Morris Goodkind, bridge engineer of that division. The superstructure, which will be typically modern in its essential features, was planned by Waddell & Hardesty, consulting engineers of New York City, under the direction of Mr. Goodkind.

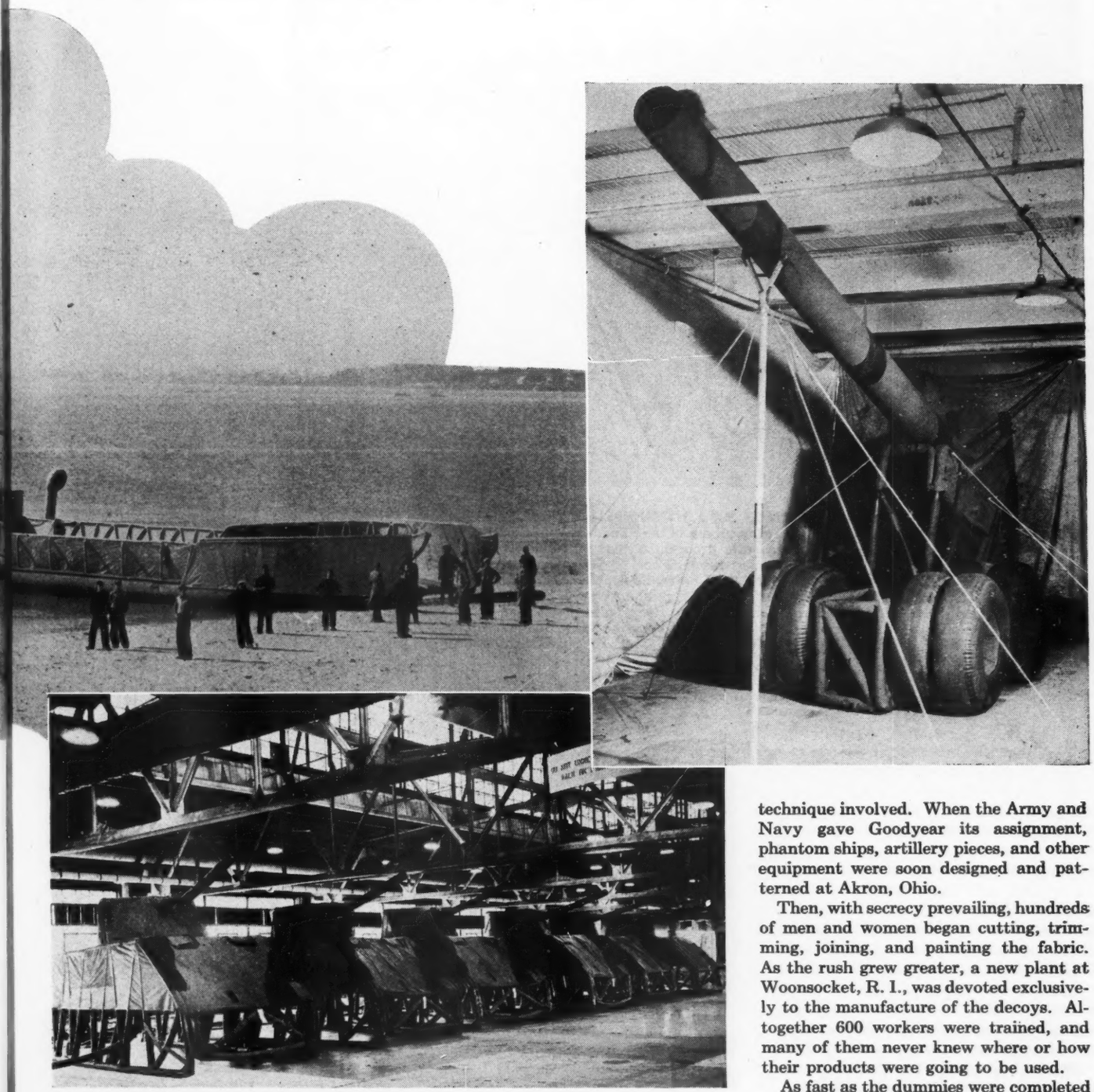
A SHIP THAT NEVER SAILED

Steps in putting a make-believe LCT in the water on an English coast. Right—The compact package containing it is unwrapped on the beach. Below—As air is injected into its various compartments, it begins to assume form. Bottom—The fully inflated craft is launched by a few sailors. Center of pages—Even at close range the floating dummy looks fairly real. From the height at which enemy spotters had to fly, it provided complete deception.

IT IS now common knowledge that deception played an important part in the war in Europe. The Germans created "ghost" cities near vital manufacturing centers in an effort to trick Allied bombers into blowing up unpopulated and unproductive areas. Adopting the same ruse, the British created fake airfields to draw enemy attacks and shield their real air bases. Now it has been disclosed that huge armadas of counterfeit landing ships and related craft that originated in the United States were concentrated at various points along the English coast to confuse enemy spotters prior to the Normandy invasion of June 6, 1944.

These spurious fleets were made up of nothing more deadly than balloon-fabric dummies filled with compressed air. Built to size and painted to resemble the real thing, the "ships" and their cargoes were purposely massed in British ports where the German reconnaissance pilots were sure to see them. Naturally, Allied Supreme Headquarters had no intention of

Pneumatic Dummies Served as Invasion Foil



PSYCHOLOGICAL WEAPONS

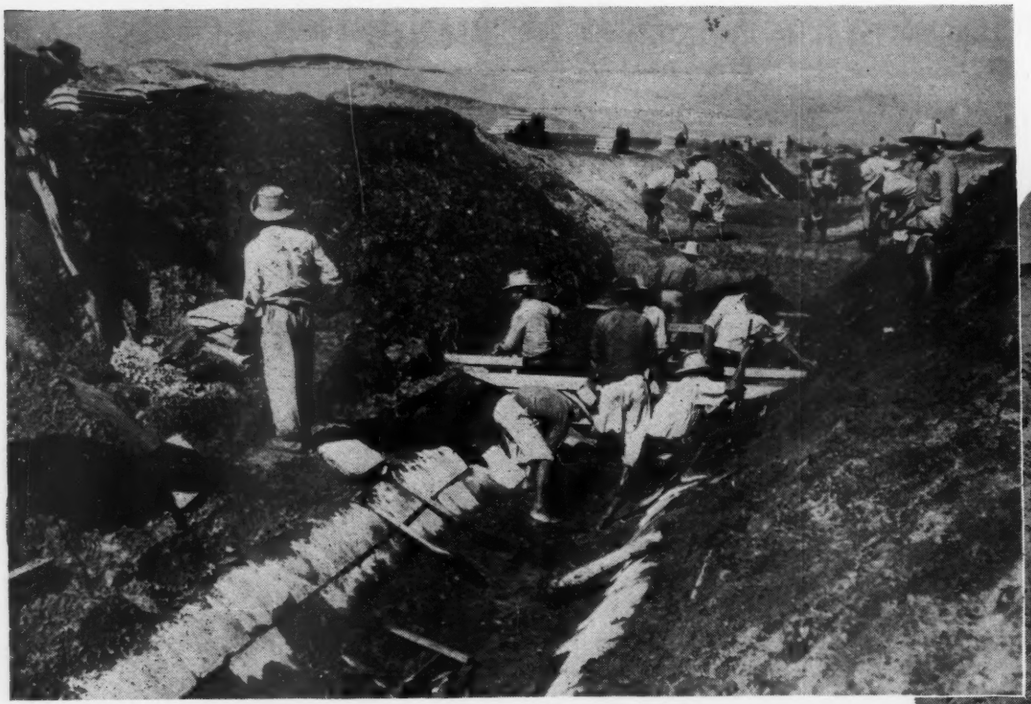
Tanks (above) and a land gun (upper right) of inflated balloon fabric assembled in a Goodyear plant for pre-shipment inspection.

launching an attack from those ports. The formidable displays were merely decoys to screen the bustling invasion preparations that were being made elsewhere. Reproductions of LCM's, LCT's, PT boats, and other naval units were given a semblance of reality, and on the "decks" of some of them were mounted convincing-looking "tanks" that were likewise constructed of cloth and inflated with compressed air.

These simulated instruments of warfare were produced in factories of the Goodyear Tire & Rubber Company, among others, for years of experience in fashioning giant cats, clowns, tramps, and serpents for circuses and parades (notably Macy's Thanksgiving Day spectacle in New York) had taught its workers the technique involved. When the Army and Navy gave Goodyear its assignment, phantom ships, artillery pieces, and other equipment were soon designed and patterned at Akron, Ohio.

Then, with secrecy prevailing, hundreds of men and women began cutting, trimming, joining, and painting the fabric. As the rush grew greater, a new plant at Woonsocket, R. I., was devoted exclusively to the manufacture of the decoys. Altogether 600 workers were trained, and many of them never knew where or how their products were going to be used.

As fast as the dummies were completed they were turned over to the Army and Navy for shipment to Europe, deflated, and folded with an eye to saving precious cargo space. The last shipment, with D-Day knocking at the door, was rushed to England by plane. Upon arrival at designated ports, they were unpacked, filled with air supplied by portable compressors, and launched. After a few days, having served their confusing purpose there, they were deflated and moved by truck to another false base, again to distract enemy attention and further muddle his defense preparations.



IMPROVEMENTS AT CHIMBOTE

It is intended to make Chimbote, near the mouth of the Santa River, the center of an extensive industrial development, and a program of improvements has been carried out there since 1942. The town was laid out 75 years ago by Henry Meiggs, an American engineer who built the Central Railway of Peru. Chimbote Bay is one of the finest natural harbors in South America. One of these pictures shows a long pier being built from the shore into deep water. Another of the works carried out was the drainage of lagoons around the town that harbored malarial mosquitoes. The work was done almost exclusively by native hand labor, as shown in two of these views.

Peru Developing Natural Resources

*Charles A. Howard**

PERU has extensive plans for developing her natural resources, including the construction of one of the largest hydroelectric stations in South America—the 125,000-kw. Canyon del Pato project on the Santa River some 250 miles north of Lima. Important as this power plant is to the future economy of the country, it is only part of a larger program which envisions full development of the waters of the Santa, Peru's largest west-coast river; exploitation of the Santa Valley's anthracite reserves estimated at ten million tons; possible erection of a steel mill close to the port of Chimbote near the mouth of the stream; an irrigation project to bring water to 250,000 desert acres; and, at a later date, a cement plant and other industries using the power to refine magnesium and other minerals which are said to exist in this region in commercial quantities.

All these undertakings and plans have been brought together through the formation of the Corporacion Peruana del Santa headed by David Dasso, formerly Minister of Finance and Commerce, and, according to Peruvian estimates, will cost about $30,000,000. An Export-Import Bank credit of $25,000,000 has been made available to assist in financing purchases in the United States of materials and equipment needed in connection with the building of public works and the development of agricultural, mining, and industrial projects.

The Department of Ancash, the region involved in this program, is one of the most beautiful sections of Peru and has been called the Switzerland of South America. There the Andes rise in two great parallel chains—the Cordillera Negra to the west, with peaks of 14,000 feet and more, and the White Mountains or Cordillera Blanca whose snow-capped heights of more than 20,000 feet give the range its name. These snow fields are not only a prime tourist attraction but also provide the Santa River with a reasonably constant, year-round flow.

The valley between these two ranges, called the Callejon de Huaylas, is about 75 miles long and 20 miles wide, and lies at an elevation of approximately 9000 feet. It is an important mineral and agricultural area and has a delighful climate. The Santa rises in the south, flows northward through the valley, turns westward in a great arc, and finally cuts its way through the coastal mountains, forming a canyon nearly 8 miles long and several thousand feet deep. There, within a distance of 5½ miles, the waterway drops about 1400 feet.

The dam for the Santa River power plant is located at the head of this canyon and is nearly 6000 feet above sea level. It is 80 feet high, 130 feet wide at the crest, and, together with the tailrace, is specially reinforced to resist the erosion of sand and gravel swept down by the floods. A 5½-mile, 18-foot diversion tunnel will convey the water to the powerhouse farther down the canyon and is expected to deliver 1375 cubic feet per second. Plans call for the eventual installation of five generators, each of 25,000-kw. capacity. Two of these machines are now in place.

The station is expected to develop power at a very low cost. An 86-mile railroad which now runs from the port of Chimbote to Hullanca, a point near the

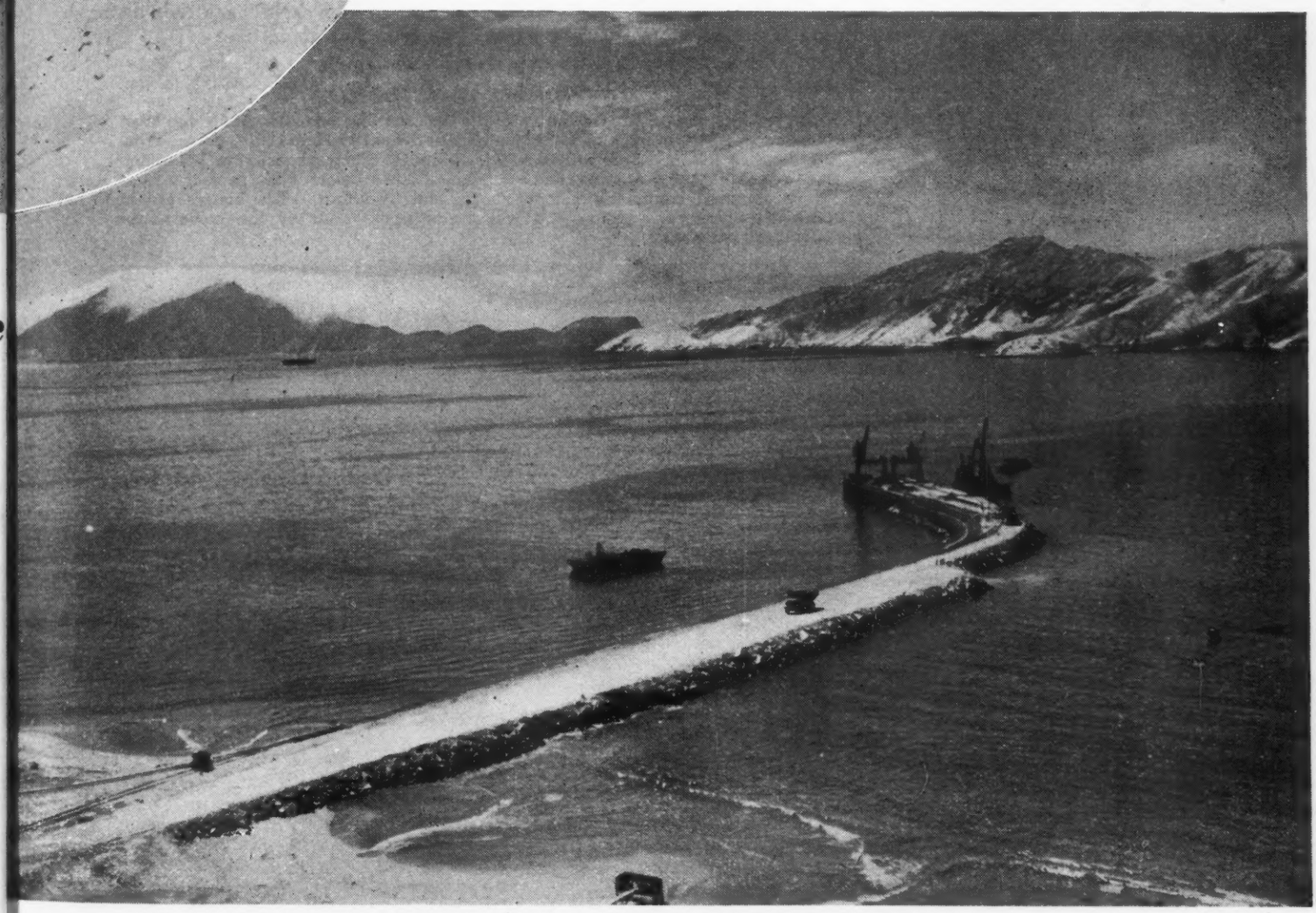
*Technical Director, Inter-American Development Commission.

power-plant site, is being extended and electrified. Some 1200 workers are employed on this job, and hand labor is being resorted to wherever possible to minimize the use of imported machinery. Barton M. Jones, a former Tennessee Valley Authority engineer, is in charge of the hydroelectric project, assisted by Andrew T. Komara, an irrigation engineer also from the TVA.

Peru's plans for bringing water to 250,000 semiarid acres on the Pacific slopes of the Andes and a little to the north of the Santa River may well become one of the really large undertakings in the Americas. Its completion would require a period of eight or ten years, and the agricultural region that would thus be created would supply the new industrial city that is expected to rise in the vicinity of Chimbote Bay following the development of power, coal mines, and other heavy industries. If the scheme to irrigate the valley should be carried out, about 100,000 kw. of additional energy might be generated by taking advantage of a drop of 4500 feet between the Santa River hydroelectric plant and the sea. Charles W. Sutton, an irrigation engineer from the United States, is acting in an advisory capacity on this project.

Chimbote Bay, which is 250 miles north of Callao and 1300 miles south of Panama, is about 7 miles long, 4 miles wide, and from 24 to 66 feet deep. It is rated as one of the finest natural harbors on the entire west coast of South America, which has few good ports. In April, 1942, construction was begun there on a modern pier which, when completed, will be more than 3000 feet long. It is to be provided with all the latest facilities for handling heavy cargo and loading steamers with coal. Sanitary work in the district was started last year by the Inter-American Cooperative Health Service and is estimated to cost around $500,000. Fuel for coastwise and foreign shipping will come from the Santa and the Chuquicara valley coal deposits 68 miles inland from Chimbote. The beds are said to be from 3 to 9 feet thick and have already been mined on a small scale. In December of 1943 about 9000 tons went to Peru, Uruguay, and Argentina.

When the harbor works at Chimbote are finished Peru will have three fine ports on the Pacific, the others being Callao, the harbor of the city of Lima, and the Bay of Matarani in southern Peru. Callao has been converted within recent years at an expenditure of more than $10,000,000 into one of the best-equipped ports on the west coast, while $3,700,000 was spent in making Matarani a modern harbor in every respect. The latter is 9 miles north



of Mollendo which, as everyone who has been there knows, is only an open roadstead exposed to the Pacific where the handling of freight and passengers by launches and barges is not only costly but oftentimes hazardous. With a wharf 1476 feet long, the bay has ample docking facilities for large steamers. The main breakwater is 2122 feet long and in places goes down to the ocean bed, 127 feet below sea level. The second one has a length of 127 feet. The channel between the two is 460 feet wide.

In order to give Peru's great southern empire access to Matarani and an outlet to the markets of the world there must still be built some 39 miles of railroad to connect the port with the main line of the Southern Railways of Peru now running from Mollendo to Arequipa. A shorter line is to provide a direct link with the town of Mollendo. War-caused shortages of shipping and materials have been largely responsible for the delay in completing these two rail connections.

Regarding Peru's production of electric power in general, it should be noted that in 1938 that country had only 210 plants of all types, with an installed capacity of 102,176 kw. By 1941, however, the number had increased to 592, with an output of 219,745 kw. Of these, 251 were hydroelectric stations with 145,420 kw., 316 were diesels with 34,594 kw., and twenty were steam plants with 39,731 kw., plus five windmills. When diesel engines and small generators and motors again become available, it is generally believed that there will be a sharp growth in power plants of moderate size, as studies show that there are scores of places without adequate electric service. A $150,000 station that was recently completed near Arequipa develops 2380 kw., doubling the power supply of that community.

Peru has been famous for her metals since earliest times, and is today the world's largest producer of vanadium and bismuth. She ranks fourth in silver output and tenth in copper, and her mines also yield lead, gold, zinc, tungsten, molybdenum, and antimony. In addition, there are deposits of mercury, sulphur, tin, and nitrate. Cerro de Pasco is one of the greatest copper mines. The Castrovirrerna region has been a producer of silver and Huancavelica of mercury. But these famous mining camps, worked for centuries and still active, represent only a part of Peru's mineral wealth. Promising copper deposits are about to be opened in the Yaruicocha district near Oroya, and so are others in the Toquepala area in the south.

There appear to be large bodies of molybdenum in the Janchiscocha section near Jaûja, and the Camana mica field has started the production of sheet mica in a small way. As for lead, zinc, and silver, a mining authority recently said, "It is difficult to find any area that does not contain them." Gold has much promise in the eastern jungle regions where many rivers carry alluvial gold, some of them in commercial quantities.

Recent activities in the Peruvian mining industry include the completion by the Cerro de Pasco Copper Corporation of big coke ovens and the conversion of a lead-zinc concentrator, with a capacity of 800 tons a day, for the use of copper ores. A pilot electrolytic zinc plant, operating on an experimental basis, is now turning out 100 tons of that metal a month.

Petroleum production has been Peru's greatest mineral industry, and petroleum products, nonferrous metals, and concentrates, combined, have usually made up considerably more than half of the country's total exports and been its major source of foreign exchange.

CANYON DEL PATO PROJECT

The picture at the left shows the site of the dam that has been erected at the head of a deep gorge through which the Santa River drops 1400 feet in 5½ miles. From the dam, an 18-foot tunnel will convey the water to a powerhouse that will eventually generate 125,000 kilowatts of current. Shown below is the project village "Hidroelectra," containing offices, shops, and dwellings. The houses are of permanent-type construction and will be occupied later by the powerhouse operating personnel.

A QUARRY ON GUAM ISLAND

Mobil-Air portable compressors, wagon drills, and part of a high coral working face that was developed. At the right is an Army Engineer Negro soldier holding a drill rod with a Jackbit screwed on it. These easily detachable drilling elements have applied the safety-razor-blade principle to rock drilling. Only the bit, weighing about a pound, has to be transported to the blacksmith for resharpening. The heavy drill rod remains on the job and is used over and over by attaching sharp Jackbits to it.

How Air Helped Build a Military Base

R. P. Day

GUAM was a tranquil, sleepy island until July 21, 1944. Less than a year later the installations of a great military base had changed it to a busy American place, bustling with the business of war. The transformation was made possible, to no small extent, by native coral rock and compressed air.

Coral rock furnished the surfacing for airport runways and highways and the base-course filler for subgrades. When crushed, it was an excellent aggregate for concrete bridges. Without it, a great amount of rainy-weather work could never have been accomplished. And without compressed air for drilling, the coral rock could never have been handled so rapidly and to such good purpose. For it was air compressors and rock drills that made possible the breaking and hauling of much of the harder coral formation.

So vital was some of this work that it was assigned an unusually high priority by the island command. Air compressors, rock drills, and Jackbits were brought in with the first bulldozers. Drill steel ranked in importance with dump trucks. Air hose came ashore shortly after ammunition. The Japanese, who had worn out their welcome on Guam, never had equipment like this, even though some well-worn contractor's machinery was there for them to study.

The vaunted "Asiatic Order" administered by the Nipponese failed to improve Guam or to impress its people. The Japanese did not develop the roads. They built a crude airstrip on Orote Peninsula, using undersized tractors and rollers. All the young men of Guam were forced into this work, because Japan had never produced the machines to do it. The first big job after the Americans landed was a tremendous highway-building program. It began even before the island was secured, and much of its early success was attributable to air-powered drills and explosives which made it possible for prime movers and hauling units to move the muck out of roadway cuts.

Guam is not a tiny dot in the Pacific, as most travel books say it is. It covers 225 square miles and is 30 miles long. Compared with a coral atoll, the island is a continent. It is a clean, rugged, red-lava-bearing land of high plateaus and rocky cliffs abutting the sea. Enough first-class military highways were planned for it in the last six months of 1944 to reach from New York to Cleveland, Ohio, a distance of 536 miles.

Most of the rock drilled and shot in the roadway cuts was a metamorphosed coral, common to Guam as well as several others of the Marianas group. It contained pockets of nullipore coral and nuggets of crystal-amber calcite and weighed from 150 to 160 pounds per cubic foot. Portable air compressors with light mobile wagon

drills proved especially suitable in hurrying along much of the initial excavating. Even Jackhamers were used extensively. With each wagon drill of the Ingersoll-Rand FM-2 type there was usually a portable of 315-cfm. capacity delivering air at about 90 to 100 pounds pressure. But when Jackhamers were required, three of the JB-5 class could be operated by a compressor of this size.

In order to build wide permanent highways, it was sometimes necessary to make cuts 120 feet deep, and all these necessitated drilling and blasting. In this work compressed-air tools averaged 180 linear feet of 2½-inch-diameter hole per 8-hour shift, and once production went as high as 250 linear feet, which stood as a record. One particularly heavy cut required drilling where excavating began—at the top of a mountainside. Wagon drills were pulled up a pioneer road by cable on a tractor rear-end winch, and the compressors were moved in as close as possible to the base of the mountain. That ordinarily inaccessible spot was reached by the wagon drills only because they were portable. It is not known whether the Seabees' wagon drills were ever made to climb trees, but if they had been called upon to put holes in trees it is a good wager that they would have attempted it!

Eighteen-foot holes, spaced on an average on 10-foot staggered centers, proved adequate for most of the highway work. Where calcite was encountered the interval between holes was about 6 feet; but soft coral was loosened up and permitted an increase in shovel output with holes on 15-foot centers and loaded with a powder ratio of 1⅛ pounds to 1 cubic yard. On one such cut a 2½-yard shovel, digging as fast as possible, accounted for 80 cubic yards an hour, much to the detriment of its boom and dipper-stick assemblies. When air-operated drills and explosives were brought in, shoveling immediately jumped to 140 cubic yards an hour. After blasting, the coral loaded readily so that the dipper teeth no longer made marks against the face of the bank and shovel up-keep was reduced appreciably.

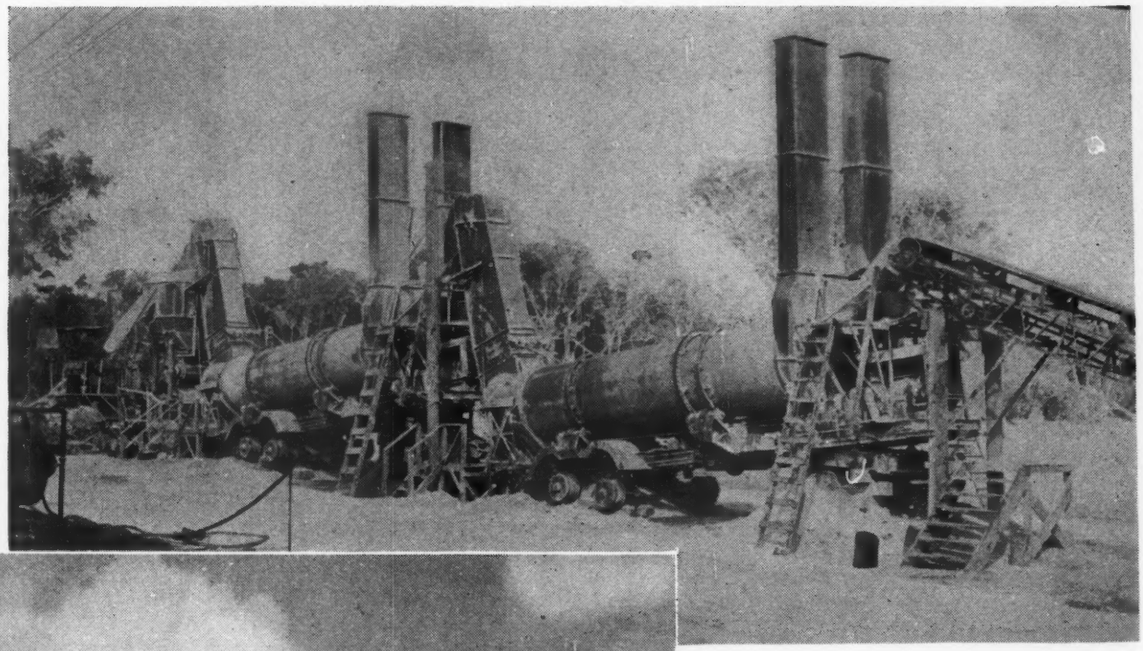
Portable compressors and Jackhamers were also used to advantage by the Seabees in shaping the ditch sections of military roads passing through rocky terrain. Many of the main arteries are 3- and 4-lane black-top superhighways, with minimum 600-foot-radius curves and 4-foot superelevation on the outside. In order to take care of the 80-inch normal rainfall, a drainage ditch had to be dug on the inside of the curve, on the low side. This always passed through solid rock when the curve was located in a heavy cut section, and drainage ditches invariably had to be excavated by the aid of drills and explosives.

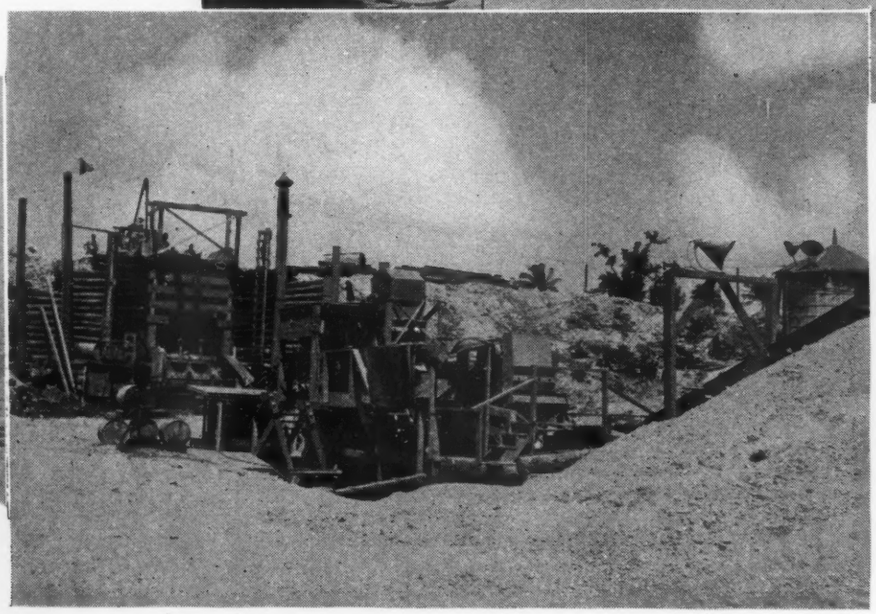
One of the heaviest jobs for compressed air on Guam in connection with earth removal was that of furnishing drill power on a big breakwater project at Port Apra. Wagon drills put in all holes 24 feet deep and less, while churn-type machines drilled holes to a maximum depth of 56 feet. Wagon drills and Jackhamers served to shape up the irregular terrain ahead of the churn drills so that the latter could be moved in and set up with a minimum of delay.

Compressors of 315- and 500-cfm. capacity were grouped, and they delivered into a common 6-inch header extending the full length of the 1.1-mile rock quarry. Air consumption was figured on the basis of 315 cfm. per wagon drill and 100 cfm. per Jackhamer. Nearly all the rock drills on the job were 55-pound Ingersoll-Rand JB-5's, machines that give good performance with a minimum of vibration and,

AMERICAN MACHINES ON THE JOB

The picture below was made in a quarry, but highway cuts presented much the same appearance. On both these types of jobs, Jackhamers (right) supplemented the heavier wagon drills. Coral rock for some uses was crushed in the Seabee-operated plant shown in the lower view on the opposite page. In it, compressed air cleaned belt idlers, greased fittings, and blew rock dust away from various places where its abrasive action was undesirable. In the Barber-Greene asphalt plant (upper right), compressed air atomized the fuel oil fed to the burners of the drier oven.





consequently, reduce operator fatigue.

Air-driven drills possessed certain advantages over churn drills at this quarry. Ground water was hardly ever present at the working sites, and fine particles accumulating at the bottoms of the holes drilled with Jackbits could be blown out much more readily with compressed air than they could be bailed out in the case of churn drills, for all the water for making mud in a churn-drill hole had to be hauled in by tank truck.

The work done by the FM-2 wagon drills was slightly better than that of the churn drills on the basis of cubic inches of hole put down in a given period. This is always an excellent comparison, for it is a direct index of the amount of the powder charge. Churn drills averaged one 56-foot 6-inch-diameter hole in sixteen hours, representing a volume of 19,000 cubic inches. FM-2's averaged 360 linear feet of 2½-inch hole in sixteen hours, with a volume of 21,211 cubic inches. More than 1,500,000 cubic yards of rock was broken by air-powered drilling equipment for the big breakwater at Port Apra, the Seabees averaging as much as 3800 cubic yards a day for a month, or 800 yards better than the contractor's 1941 estimate.

Storage areas covering up to 50 acres were excavated by modern machines, using the simple method of finding a balance point and then leveling all the topography to that grade. Easy, yes, with compressors furnishing air to drive drills into some of the toughest rock in the Pacific. Air also served its purpose in laying oil and water pipe lines. Much of the piping had to be placed below ground in rocky areas too tough for trench hoes or conventional ditchers. There wagon-drill holes, spaced on 6-foot centers and loaded with high explosives, did the trick. Often only two or three drills managed to stay ahead of trench hoes averaging 600 to 800 feet of ditch a shift. Even after the pipe lines were welded together in sections 60 feet long air played its part in lowering them to the bottom of the trenches, for the controls of many of the truck cranes used in this work were air-activated.

Huge tank farms on Guam for the storage of aviation gasoline, diesel fuel, and black oil owed their beginnings to compressed air. Space was at a premium on the island, but necessity more or less rigidly dictated just where the big steel tanks were to be located, the primary requirement being to put each one near an airfield. This could usually be done and still utilize ground useless for other purposes, such as hillsides, heavy jungles, or rocky areas. We won't enter into their construction details here because a project of this type was described in the October, 1945, issue of COMPRESSED AIR MAGAZINE.

Water tanks were set on timber towers held together by bolts inserted in air-drilled auger holes. Diesel engines in powerhouses were impotent things without starting air to set them running. Pile bents in bridges were capped in record time by air tools—by chisels, augers, and chippers. Air-operated well points produced water and dried up wet, soggy areas of ground. Faulty patches of asphalt on airfields were chipped out by means of pneumatic gads and then patched. Even the plants which produced this hot-mix surfacing needed some compressed air. One, badly in need of steam but underpowered in that respect, used air for atomizing the diesel fuel in its drier-oven burner tips, thus solving a perplexing problem.

Air was, indeed, one of the "secret weapons" of the war. Compressed and controlled by present-day improved American equipment, it proved to be a tremendously effective tool in the hands of Seabees, many of whom have since then realized their ambition to walk through the streets of Tokyo.

Bureau of Reclamation Photo.

SHOWN above is A. E. Kirstein, Bureau of Reclamation employee, using a pneumatic grinder supported by a "pressure jack" that he developed. Prior to its introduction, overhead grinding in the 18-foot-diameter steel penstocks at Grand Coulee Dam required the services of two men. Mr. Kirstein asserts that with his appliance he can equal the work of two 2-man crews using ordinary supports. The jack weighs only 6½ pounds and has three devices for changing its height. One is a tension spring on the telescoping support rod, another is a set-screw arrangement similar to that on a camera tripod, and the third is an adjustable screw at the base that rests against the basal support and has a range of two inches.

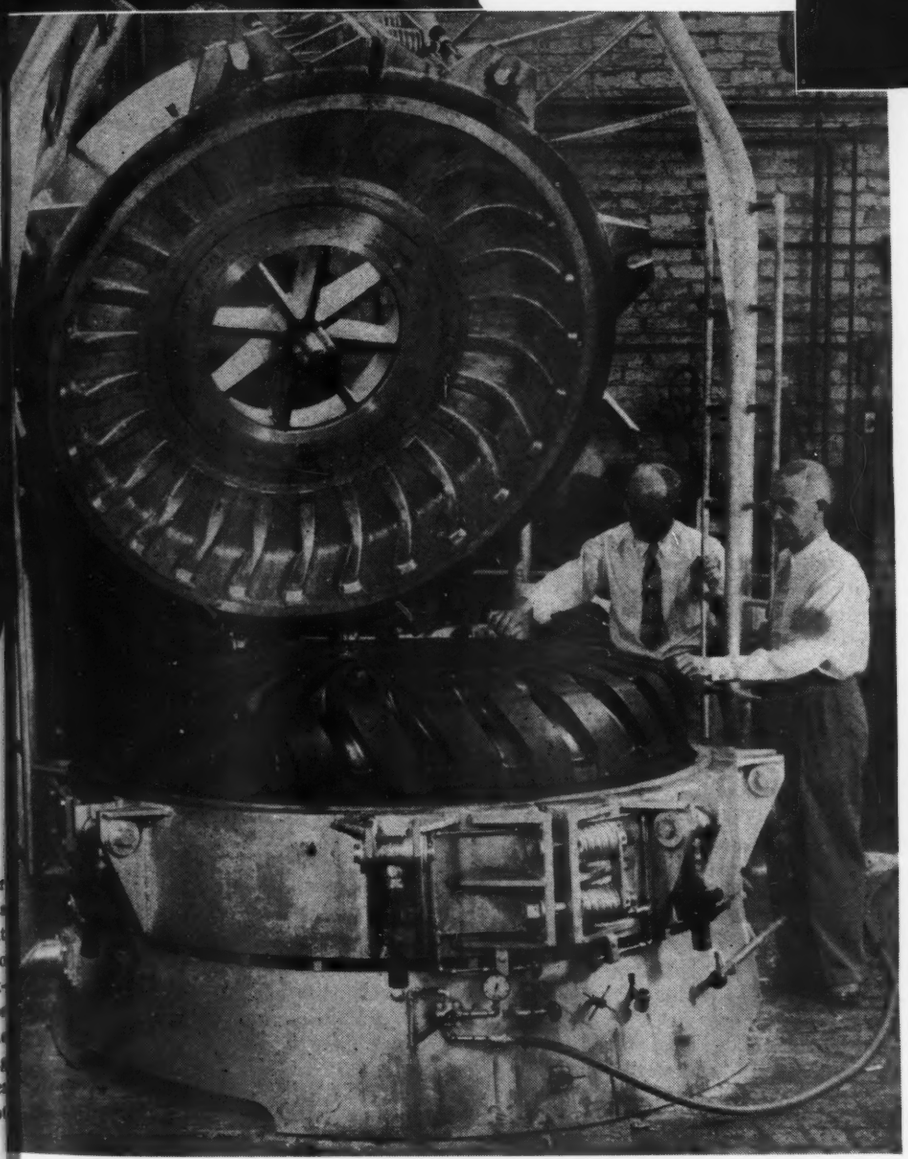
FEW TOOLS introduced in recent years have done as much to lighten labor and save time as the pneumatic impact wrench. Its job is to run nuts and cap screws on and off threaded bolts and studs. Its action is akin to that of tapping the sides of a bolt with a hammer, but the wrench delivers up to 2000 impacts per minute. With the turning power it makes available, a workman can tighten a nut or cap screw to any desired degree and can loosen or remove "frozen" ones that would otherwise have to be cut or burned off. The picture above shows a mechanic in a New York taxicab repair shop removing nuts of ⅜-inch thread size from bolts on an automotive engine. He removes 32 nuts in an average time of 5 minutes, whereas at least 20 minutes and a lot of exertion would be required to do the job by hand.

ON SOME types of military aircraft, radar units are carried under one wing. To provide protection for the sensitive instruments, special coverings called "radomes" were developed. The body of the enveloping case is made up of woven glass-fiber cloth laminated with Bakelite polyester styrene resin and is molded over a mandrel. After being cured in an autoclave, it is then ready to be removed from the mandrel for finishing. It is blown off with compressed air as shown at the left, the air being introduced through the top of the mandrel at the right end. The plastic dome is then cut to length and joined with a metal tail piece to form a complete unit.

Photograph from "Bakelite Review"

COMPRESSED *Air* AT WORK

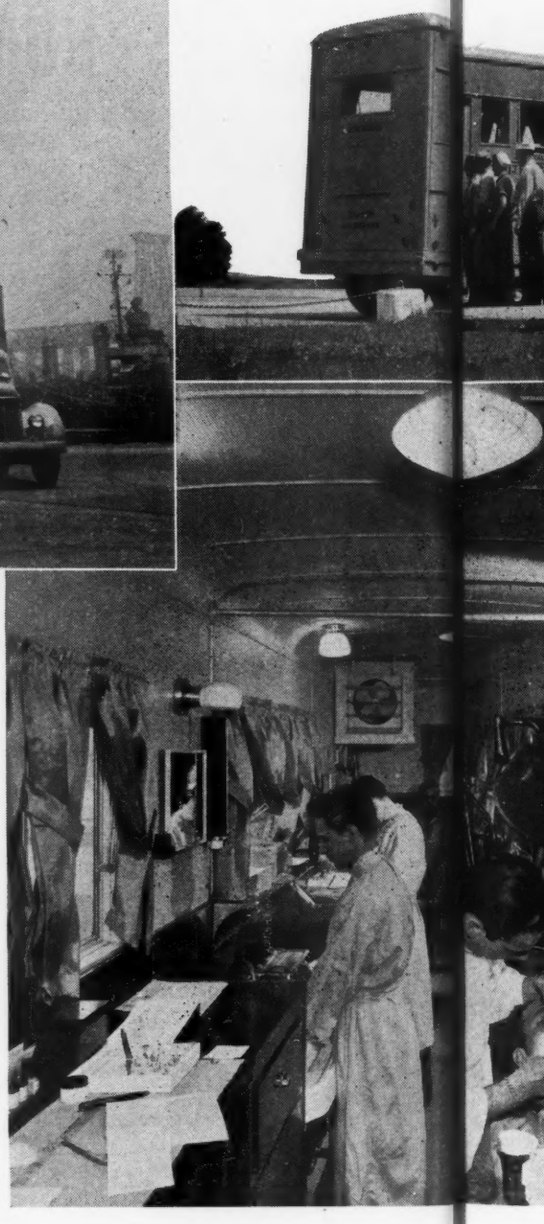
GOGGLE cleaning in industrial plants is made easy by the Sani-Spray cabinet shown above. When a button on the front of the cabinet is pressed, a fine mist of cleaning fluid is sprayed on the goggles through a nozzle at the side. Paper tissues are provided for wiping off the fluid, which not only cleans the goggles but also fog-proofs them, thus assuring clear vision that promotes safety. The spray is produced by connecting the plant air line to a refillable quart jar of cleaning fluid inside the cabinet. An adjustable control valve limits the amount of spray delivered at each application. This appliance is made by the Allen Optical Company, Buffalo 2, N. Y.



A HUGE pneumatic tire for use on heavy earth-moving equipment is shown at the left in a mold where it has just been retreaded. This machine, one of the largest yet built, will retread tires up to 21.00-24 size and was made by the Super Mold Corporation of Lodi, Calif., for the Rogers Super Tread Service of Yakima, Wash. In the tire-curing operation, a tube is inserted in the casing, the latter is locked in the mold, and the tube is inflated to force the casing into the mold recesses while heat from circulating steam effects the curing. The air pressure used varies with the size and weight of the tire and is 235 pounds in the case of this mold.

Mobile Dental Units for the Navy

Robert G. Skerrett



Official U.

A LONG pull, a strong pull, and a heave was how the men of the old Navy handled the ropes in the days of much running rigging in the fighting fleet. And the service doctors then used much the same forceful procedure in pulling aching teeth that could not be soothed by tonguing a quid of plug tobacco against them. Bluejackets and those above in rating and rank fought shy of the ship's doctor as long as they could because the removal of a troublesome tooth left a painful reminder of the operator's lack of skill and of the clumsiness of his instruments.

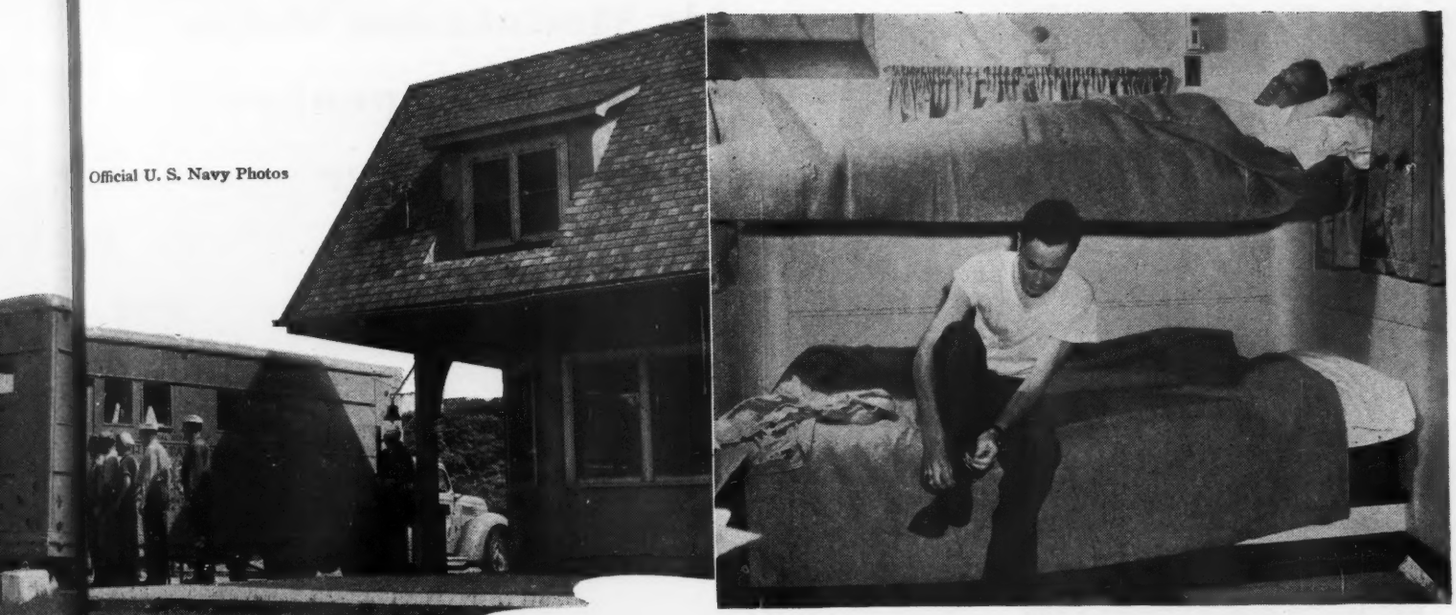
So much for a contrasting background to the skill of the Dental Corps which is now a part of the Medical Corps of the U. S. Navy. These latter-day experts not only safeguard the smiles of the men of our battle fleets but they contribute to the physical fitness of the personnel. Further, a recent innovation makes it possible for the Dental Corps to go far and wide on shore to naval stations and districts to look after the dental requirements of the men and women in Navy uniforms.

As announced a short while ago by naval authorities in New York City, "If a sailor can't get to a dentist, then the dentist goes to the sailor," and in so doing he takes along with him the best of equipment so that he can give the bluejacket the finest treatment. Such is the reason for the new mobile dental units, each of which is in the form of a motor truck and trailer with a combined weight of 14 tons and costing, complete, the good round sum of $22,000. The idea of mobile units is credited to Rear Admiral Alexander G. Lyle (Dental Corps) USN., the Navy's dental chief, and the actual engineering and supervision of construction were placed in the competent hands of Commander A. W. Borsum, (DC) USN., of the planning division of the Bureau of Medicine and Surgery of the Navy Department.

In the Third Naval District, which embraces New York, Connecticut, and the northern part of New Jersey, two mobile units were assigned to handle the dental demands of some 13,000 Navy men and women stationed where there were no provisions for naval dental treatment or where the existing facilities were inadequate. Each is designed and outfitted so that it is entirely self-contained and may be operated independently of local water and electric services. To this end there is provided a jeep gasoline engine that can be hooked up to an adjacent electric generator capable of supplying current for an X-ray machine, water and air heaters, sterilizer, lighting fixtures, and the dental operating equipment with its cauteries, warm-air and water syringes, and aspirators or saliva siphons. Current is also drawn from the same source for electric diagnostic instruments and for driving motorized machines, including the compressor which furnishes air for a diversity of purposes.

The water tank aboard has a capacity of 120 gallons, and a flow with ample "head" to all points of discharge is maintained by applying pressure to the free surface of the water. In addition, compressed air is needed in the operating room to actuate atomizers; for the driers used to prepare a cavity for filling; for the warm-air syringes that finish this preparatory work; for blowpipes that clear away particles resulting from drilling and grinding; and for the aspirators that

Official U. S. Navy Photos



KEEPING THE BITING LINES READY FOR ACTION

In the top-center picture sailors are shown lining up at the Naval Magazine at Montauk Point, N. Y., to receive treatment by traveling dentists. The inside of the trailer is illustrated below it and has all the appointments of a civilian dentist's office. While the mobile units can't go to sea, they do the next best thing by giving dockside attention to ships' crews, as seen at the extreme left. By day the rear end of the vehicle is a patients' waiting room; at night it serves as a bedroom for two of the personnel (above).

prevent an open cavity from being flooded with saliva while the dentist is busy on a filling. A puff of air also serves to blow clear the hypodermic needles that are utilized to deaden the area around a tooth to be extracted. Moisture left in them might lead to clogging or impairment. Air under pressure, if need be, can be diverted into the line leading to the pneumatic brakes of the truck should the normal supply fail for one reason or another. The air reservoir for the brakes is usually charged from an outside source.

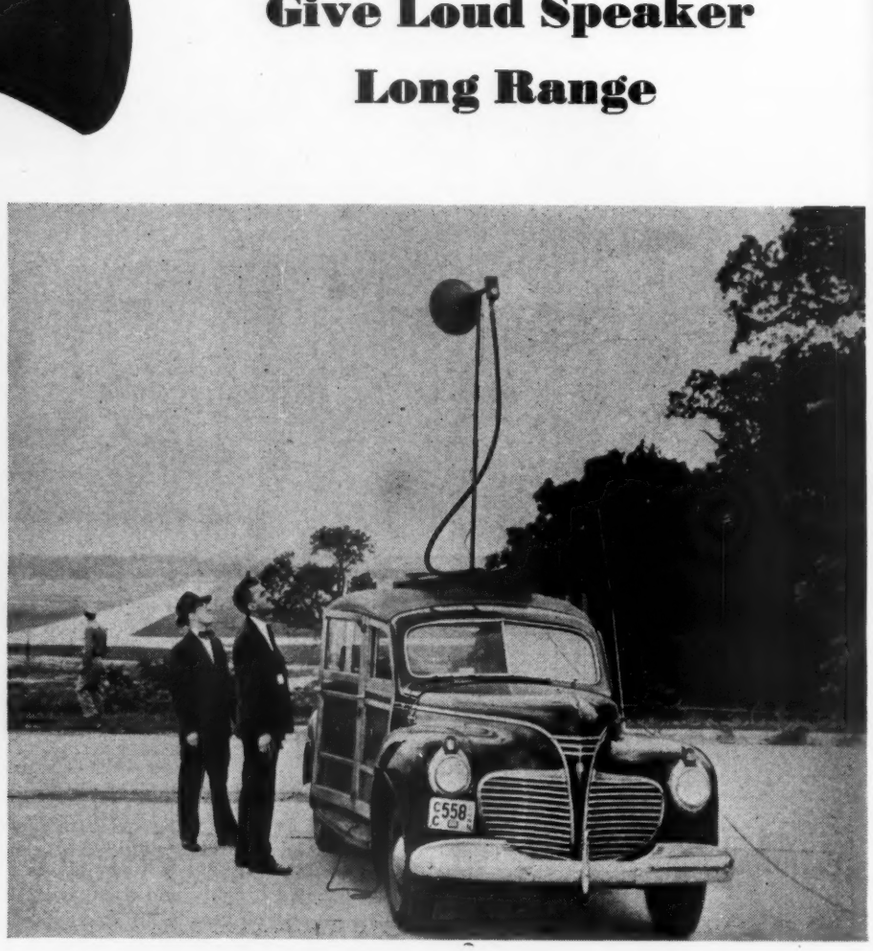
In the operating room of the trailer are two dental chairs complete with every up-to-date apparatus and equipment. There is a dark room in which X-ray plates can be developed quickly and dried with dispatch, approved means for sterilizing instruments, in fact everything required for dental work. The personnel is made up of two dental officers, two dental technicians—the latter hospital corpsmen, and the driver of the unit. There are comfortable sleeping accommodations in the trailer for some of this group, as well as a washroom that meets every need. In the daytime, that end of the truck is the patients' waiting room.

The itinerary is arranged by an officer of the Dental Corps who is assigned to each naval district. For example, in New York State the assignments may include visits to any base where men are being trained for service in the Navy, or a unit may have to make a run to the U. S. Naval Magazine at Montauk Point at the easternmost end of Long Island, or it may have to go to any of the naval stations in New Jersey and Connecticut. Furthermore, the two units now in New York are expected to serve the waterfront of the Metropolis—to draw up alongside ships at piers to take care of the dental needs of the officers and men aboard the vessels moored there. The naval authorities are enthusiastic about the work these trailers have already done, and it is confidently expected that the new facilities will do much to improve the dental health of Navy personnel. More than that, when some of the men and women return to civilian life they will be further benefited because the dental service has made them aware of the value of prompt oral care and that the condition of the teeth greatly affects our well-being.

By the end of July of last year there were nine of these mobile units in operation within various sections of the United States, the practice being to hold a trailer at any given spot until everybody there whose teeth require attention has been treated. The dental officers assigned to the units are experienced men who are trained to do their work well and expeditiously, and the organization aboard reflects naval indoctrination and discipline. For instance, the two units in the Third Naval District were under the command of officers who were dentists in private practice in New York but who had returned from sea duty. One, Lieut. Commander Richard J. Warnecke, (DC), USN., entered the Navy in 1942 and saw twenty months of service aboard an aircraft carrier before being ordered to his mobile unit. The other was under Lieut. Harold Y. D. Bonsole, (DC) USNR., who was commissioned in January of 1943 and had served on an attack transport in the Atlantic.

An interesting side light on this new naval activity is that the Dental Society of the State of New York donated to the Navy $4000 worth of scrap gold—saved by its members—to cover the cost of certain equipment that was placed aboard the first of the mobile dental units commissioned in the Third Naval District.

Air Modulation Helps Give Loud Speaker Long Range



SMALL BUT POWERFUL

Engineers of the General Electric Company demonstrating the new loudspeaker to officers of the Air Technical Service Command at Wright Field, Dayton, Ohio (right), and to Boston fire and police officials. The system operates on the same principle as the human voice, using compressed air instead of lung power to modulate the sound. This, together with a high degree of amplification, gives the unit an audible range of 3 miles and more. The entire installation is self-contained and compact for portability and may be mounted on a small truck or station wagon.

"OLD LOUDMOUTH" is the nickname that has been given to the General Electric Company's new loudspeaker, and it certainly seems to live up to it, for it is reported to be 150 times more powerful than the average apparatus of its kind. Conventionally, it is known as Super-Aire Speaker because it transmits speech with the aid of compressed air on much the same principle as it is done by lung power. Tests and actual service have demonstrated that the speaker can project the voice under average weather conditions for a distance of 3 miles plus with a high degree of intelligibility, and it has been heard as far away as 5 miles.

Whereas it has been customary in covering large areas to use multiple-speaker installations requiring heavy-duty amplifiers with an output of many hundreds of watts, the new system is small and compact enough to be portable and, though provided with a 50-watt audio amplifier of special design, calls for the use of but 25 watts. Sound is transmitted to the Super-Aire through the medium of a microphone, phonograph record, or wire recorder, or directly and automatically by an electronic signal generator. It goes into the amplifier and thence into an airtight voice coil and valve assembly or driver unit. Simultaneously, air at approximately 20 pounds pressure also enters the coil. The air is supplied at the rate of about 14 cfm. by a compressor that is an integral part of the speaker and is operated either by a 1½-hp. motor or a gasoline engine. If the latter is used and no alternating current is available, then a generator is attached to furnish the necessary voltage for the amplifier.

When the audio frequency current passes through the driver unit, which is suspended by flexible supports, vibration is set up parallel to the coil and, in turn, causes the associate valve to vibrate in accordance with the amplitude of a sine wave form. This valve controls the compressed air and thus diverts a stream through a large number of 0.006-inch slits, modulating each separately. This combination of audio frequency current and compressed air, when converted into acoustical power, makes for a long-range high-fidelity reproducer. The frequency depends upon the system of acoustic loading and varies anywhere from 100 to 10,000 cycles.

The method of operation on which Old Loudmouth is based is similar to that of the throat and vocal cords. In other words, modulated sound is forced by compressed air to the horn, and the effect is the same as that of the voice, except that the speech is amplified to any desired degree of loudness. The output is far too powerful for close-up use, and the apparatus is not recommended for distances under 300 feet. It is serving today in military airports and navy yards, and has a wide field of postwar application in harbors for directing traffic, in railroad classification yards, in police- and fire-department operations, in flood and disaster work, on expansive construction projects—in fact anywhere where it is necessary to use a system that is capable of delivering sound at points remote from the source and of overriding high noise levels.

Excessive Air Pressure Needed to Sink Piers

WHAT may well be the deepest pneumatic caisson ever used in bridge building in the United States was required in excavating for Pier 3 in the Colorado River at Toprock, Ariz. At that point the Atchison, Topeka & Santa Fe Railroad has built a span having an over-all length of 1507 feet and resting on abutments and seven piers of two cylinders each tied together at the top by a reinforced-concrete apron. Five of the piers were sunk through water-bearing material under air pressure and have a footing not less than 2 feet deep in bedrock. At the site of Pier 3 there was an abrupt dip in the bottom, making it necessary to dig considerably deeper than had been contemplated in order to obtain a flat bearing surface for the twin 22-foot cylinders. In short, the excavation for the west-side toes of those structures had to be carried 20 feet down through the breccia rock so that the east toes might be embedded in it to a depth of 2 feet.

Before that pier reached its final resting place about 120 feet below mean water level, the air pressure under which the men worked had to be raised to 52 pounds per square inch, or 2 pounds higher than allowed under the code of the Arizona Industrial Accident Commission. By limiting the shift to 30 minutes, the contractor was granted permission to continue operations. Air from the compressor plant on shore was delivered by a 6-inch pipe line laid on the temporary wood-pile trestle across the Colorado from which the excavating and concreting were done. Because of the great heat that prevails in that part of the country in summer, part of the pipe was placed in a trough of running water so as to lower the temperature of the compressed air. Wet sacking also was used in the air-lock chambers and elsewhere to make working conditions as comfortable as possible

Pneumatic Bomb-Bay Doors

ADDITIONAL details have now been released regarding the pneumatic equipment that is used for opening the bomb-bay doors of B-29 bombers and that was the subject of the cover picture on our April, 1945, issue. The mechanism was developed by Boeing Aircraft Company engineers to reduce the time a plane would be on its dead-course bombing run at constant speed, because it was found that too many enemy guns were getting the range during that critical interval. The new apparatus succeeded so well that the doors could be opened and closed in a total of 2.1 seconds (0.7 second for opening and 1.4 seconds for closing), as compared with the 50 seconds previously required.

The door-actuating mechanism consists of a pair of double-acting air cylinders to which compressed air at 175 pounds pressure is admitted by a remotely controlled solenoid valve, of pneumatic door latches, of a regulating valve for maintaining the system air pressure at the desired level, and of miscellaneous fittings and electric-circuit devices. The air is supplied by an electrically driven compressor built especially for aircraft service, and there is a reservoir for storing sufficient air to move the doors through four operating cycles.

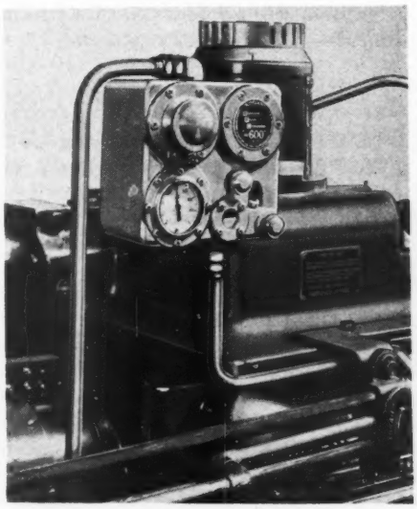
Substitution of the pneumatic equipment for the former motor-driven mechanism resulted in lightening each plane by 200 pounds, which is the equivalent of more than 33 gallons of gasoline. The control valve for admitting air to the operating cylinders was developed by Adel Precision Products Corporation and was tested at temperatures ranging from 165° to –65°F. and with air at pressures up to 450 pounds.

A Triple-Duty Air Appliance

A DEVICE for use with pneumatic equipment and that performs the triple service of regulating the air pressure, filtering the air, and lubricating a machine has been introduced by the Logansport Machine Company under the name of Logan R-F-L Unit. It includes in one casting, measuring 6x6x4¾ inches, all the individual components by which these things are customarily done and which constitute a rather awkward "Christmas tree" assembly. The unit is interposed in the air-supply line serving the machine and may be mounted either on or convenient to it or on a central control board. All the necessary connections are built into the casting, and controls, gauges, etc., are on a front panel.

The manufacturer states that the R-F-L can be used effectively with either new or old pneumatic equipment. By reason of its regulating feature it levels out surges and sudden drops in air volume and maintains a steady working pressure that insures peak machine production. Filtering the air removes rust, scale, moisture, and other unwanted matter, thus promoting unfailing operation and reducing wear on parts of machinery. Lubrication of the latter is accomplished by the continuous injection of oil mist into the air supply.

Two knobs are provided for adjusting the air pressure and the amount of oil introduced in accordance with the requirements of the equipment or the particular job being done by it. A third knob controls the opening of a drain on a reservoir into which condensed moisture drops after it has been separated from the air by the filter. The filter itself is of porous metal and is readily removable for cleaning or replacement. The R-F-L Unit is designed for use with air pressures up to 150 pounds per square inch.



IN SERVICE
This view shows a Logan R-F-L Unit mounted on a Warner & Swasey turret lathe.

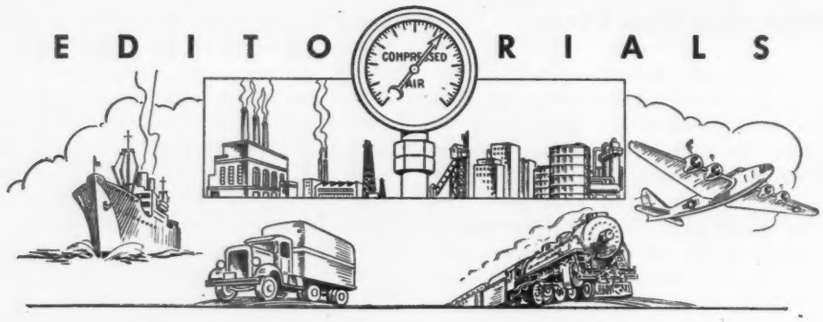
Packaged Electric Controls

PACKAGING has reached a new high in the case of a system known as Stratopax, which was developed by the Cook Electric Company during the war for its own use but which was soon pressed into service by other manufacturers. Packaging, as the term is commonly understood, means temporarily wrapping or encasing goods for shipment or storage. Stratopax goes much farther than that. It's a permanent protection—the product remains packed throughout its whole service life.

The idea was conceived primarily to eliminate the hazard of fire through insulation breakdown and excessive arcing in standard electrical controls such as relays, contactors, circuit breakers, and switches for high-altitude aircraft. It has been found, however, that it also insures trouble-free operation in areas where that is normally not possible because of weather conditions or the presence of dust, etc.

By the new method, one or more devices are hermetically sealed in a metal container. This is shaped to fit the parts and the available space; has provisions for mounting and for all necessary electrical features; and includes inspection ports, test lamps, etc. After assembly, each unit is heated to get rid of moisture which might cause corrosion, is evacuated, filled with an inert gas, and sealed. The gas introduced is high in thermal conductivity to avoid overheating in service. Additional safeguards to this end are radiating flanges and expanding bellows sections. Before it goes out of the plant, each package is tested for tightness with apparatus that can detect gas leaks which, expressed in terms of air, are as minute as one-billionth of a pound per hour.

EDITORIALS



FARM MECHANIZATION

IN SURVEYING the potentialities that different fields of endeavor offer for technological advances, one should not overlook the farming industry. Although it is the bulwark of civilization, and gives livelihood to more persons than any other line of work, agriculture is the last of our great industries to feel the influence of intensive mechanization. This is probably because the average farm is a one-man enterprise. As in a one-man shop, hand labor still accounts for much of the output. Large, company-owned farms have taken the lead in applying machinery to the various tasks at hand. Similarly, in Russia, where communal farming is practiced, mechanical aids are much used.

The postwar era is bound to bring acceleration to the farm-mechanization movement in the United States. Except in the South, adequate farm labor is becoming an increasingly grave problem. Here, as elsewhere, necessity will prove to be the mother of invention and machinery designers can be counted upon to provide additional apparatus and devices to swell the per-man production. The need for this is especially important in view of the prospects that a considerable proportion of American agricultural output must be sent abroad for some years.

Mechanization tends to increase the production per acre as well as per man and is accordingly of vital significance in nations of dense population. It is consequently not surprising to find the relatively congested British Isles turning eagerly to farm machinery. Britain's belt was drawn tight during the war period and she still hasn't been able to let it out many notches. She realizes keenly that her soil must be made to grow more of what she consumes, and mechanization offers one way of accomplishing this. Already the British claim the leadership in this respect, with more than seven tractors to every square mile of arable land and more than two for every square mile in the islands. The mechanization movement there is headed by the National Institute of Agricultural Engineering and one of its principal goals has been the development of machinery suitable for use on small farms. Power-driven equipment for harvesting grains and sugar beets, for digging potatoes, and for drying and handling grains have been produced and are being demonstrated with the hope of getting farmers to adopt them. Similarly, improved plows, harvesters, and cultivators have been developed, and better ways of using them are being taught.

In the United States, the manufacture of farm machinery will be a billion-dollar-a-year business for the next several years. The demand for tractors alone is forecast by one authority as 250,000 a year for the next five years. There are already some 2,100,000 agricultural tractors in service, which is reflected by a decrease in draft animals from 24 million in 1921 to 12 million in 1944.

Typical of the many new farming machines that may be expected to appear is the Rototiller, which prepares the ground for immediate planting by churning and crumbling the soil with rapidly revolving steel tines. In the Willow Run plant where Ford made Liberator bombers throughout the war, the Graham-Paige Motors Corporation is now preparing to build 50,000 Rototillers during its first year of full production.

Compressed air equipment has proved to be adaptable to so many applications in industry that it is bound to serve useful purposes on the future farm. A start has already been made in its employment for spraying and dusting crops and for drying hay. However, almost a virgin field awaits the efforts of the pneumatic designer, and will no doubt receive careful attention in the years to come.

AIRCRAFT RESEARCH

DESPITE the phenomenal progress it has made to date, the aviation industry is probably only getting well started. Some authorities say it now occupies about the same relative position that the automobile industry did in 1910. That is to say, the period of greatest growth is yet to come.

The manufacture of planes was big business during the war, and with the emphasis on production rather than on costs it was possible to register technological advances that would normally have taken decades. However, not all the problems have been solved and new developments will come slower under the decelerated pace of a peacetime economy. The 1946 aircraft production in this country is expected to aggregate a value of only about 6 percent of the 16-billion-dollar peak output reached during the war. Even though it will still be three times the volume of prewar 1939, manufacturers say it will not be sufficient to support an extensive research program. The Air Coordinating Committee of the Army, Navy, and Department of Commerce has recommended a minimum annual output of from 3000 to 5704 military planes as a base for expansion in case of a national emergency. The first of these figures represents a rather small increase over the 1939 output of 2141 military planes, and it remains to be seen whether the actual production will be great enough to support essential development and "pilot-line" production costs.

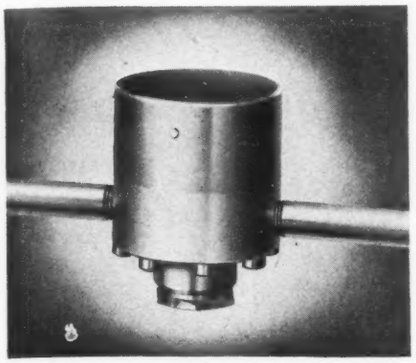
When viewed from the non-military side, the outlook is better. Our domestic airlines are flying some 550,000 miles daily, or 51 percent above the 1941 average, and are steadily adding to the total as new transports are placed in service. There is also a huge expansion in "feeder" line service in the offing, the aim being to make commercial flying facilities available to the 90 million Americans who are not now living in close proximity to established air lines. The Civil Aeronautics Administration predicts that ten years hence our transport services will be carrying twenty million passengers annually within the country and an additional two million in foreign operations.

The transition from wartime to peacetime production is a big and expensive step for the manufacturing concerns. A hint of what it involves is contained in the announcement by the Bendix Aviation Corporation that it expects to spend 25 million dollars on its reconversion program. It is significant to note that its plans include the development of instruments and appliances for the personal airplane.

In an effort to pave the way for handling greatly increased quantities of air cargo, the 23 United States flag airlines have organized a Shippers Research Division. In addition to promoting safer flying, its studies will seek to develop packaging methods for all types of airborne goods that will insure their reaching their destinations in undamaged condition. One of the principal lines of investigation will be aimed at determining the effect of changes in air pressure on various cargo items. This will involve experimentation in pressure chambers where atmospheric conditions at various altitudes can be simulated.

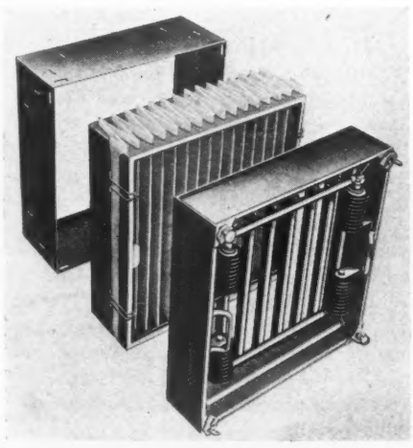
From this program it is expected to obtain information on the proper packaging of various materials that are now listed as hazardous. These include flammable, magnetic, and radioactive materials, and those producing toxic, noxious, and corrosive fumes. Present knowledge indicates that it will be desirable to develop a vaporproof self-pressure-equalizing container for flammable liquids.

Industrial Notes

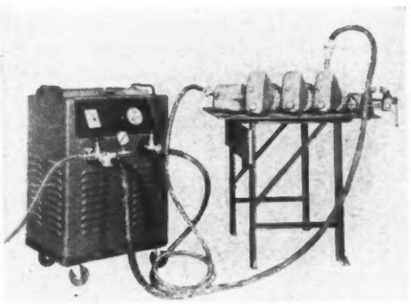


Originally developed for wartime service—for controlling the actuating medium of rockets and pack-type flame throwers, the pressure-reducing regulator for air and gases shown in the accompanying illustration is said to have a capacity range equal to that of units ten times its size. Measuring approximately 2¾ x 3¼ inches and weighing 2 pounds, it is suitable for handling initial pressures up to 3500 pounds with an adjustable control range of 5 to 1500 pounds. Special models can be supplied for a maximum initial pressure of 5000 pounds, and also for liquid service. The Mity-Mite, as the regulator is named, is made of duralumin and has stainless-steel ports. It is a product of the Grove Regulator Company and is available for ⅛- and ¼-inch piping.

American Air Filter Company has announced an addition to its line of electronic air filters that is said to be based on a new principle in the field of electronic air filtration. The unit—the Electro-Airmat—uses a collector element made of paper and trade-named Airmat. This material is built up of a number of porous tissuelike plies of short cellulose fibers in jackstraw arrangement. When an electrostatic charge is applied to the element the plies tend to separate and each fiber becomes an electrode that attracts and holds dust and smoke particles. When the paper has accumulated its dust load it is replaced with clean paper by turning the crank of a mechanical device which folds the material in conformity with the serrated base section of the filter. Spare cells with fresh Airmat can be provided for convenience in servicing. Where only a few units are required, a manual loader suffices. It is claimed that tests by the discoloration method, using a standard 24x24-inch unit with a rating of 1000 cfm. and with a normal flow through the collector element of 35 fpm., give the Electro-Airmat an "arrestance" rating for atmospheric dust or smoke of 90 percent and better.



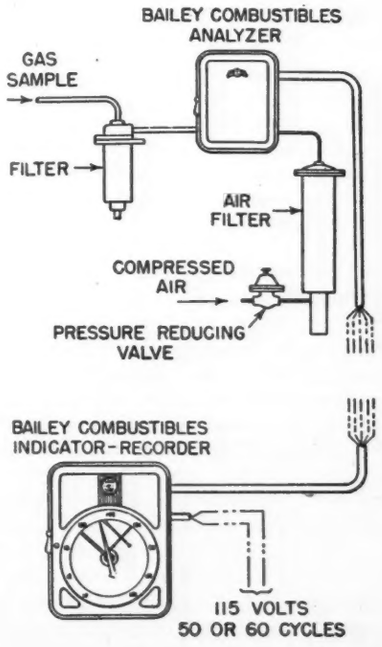
Making defective castings sound so that they can withstand operating pressures is the purpose of a portable unit developed by the Metallizing Company of America. Known as the Mogul Circulator M-1500, the equipment uses Mogul Cast-Seal, a special solution that is said to contain no deteriorating or dangerous gas-forming substances. It is applied hot under pressure and, as it circulates, penetrates cracks and porous areas where, because of the colloidal action of its base, it quickly forms metallic bonds that effectually seal the openings. The unit permits servicing two or more connected castings at one time and can test them for tightness with compressed air taken from a shop line. It is claimed that castings so salvaged have shown no signs of leakage when subjected to kerosene, hot oil, water, etc., under 200 pounds pressure.



Marked interest is being shown by American colliery operators in a radically new coal-cutting machine developed by the Nazis. It was discovered by one of the U. S. Government intelligence groups sent abroad to study German methods and machinery for the benefit of home industries. The equipment works on the principle of a carpenter's plane and shaves a slice 1-foot thick and 750 feet long from the face of a coal seam. The slab is cut from the lower third of the seam, thus causing the upper two-thirds to cave and fall over the machine into loading troughs. The planer is 15 feet long and is really two units operating in tandem. Each is equipped with a manganese-steel, plowsharelike blade, the two cutters facing in opposite directions so that a slice can be removed each trip as the machine shuttles back and forth. Pulling power is provided by an electric or air-operated hoist using wire rope. It is reported that the planer can mine 800 tons of coal a day.

Although engineers' slide rules have been in use for 300 years, the first one that will place the decimal point at the end of a long and intricate computation has just been introduced by Pickett & Eckel. Called the Deci.Point, it will determine the precise location of the decimal point in involved expressions up to nineteen places. Other advantages over conventional slide rules are also claimed for it.

Bailey Meter Company is offering a new analyzer and recorder that automatically and uninterruptedly controls and graphically indicates the combustible content of a gaseous mixture. By means of it, a continuous gas sample is mixed with compressed air and burned on a catalyst filament, which reaches a temperature proportional to the contained combustibles. Because the filament resistance is a function of temperature, a simple resistance bridge connected to a null-balance electronic recorder completes the installation. Pneumatic-control or electric-alarm contacts may be provided for 1- or 2-pen recorders. In the case of the latter, separate analyzers are used so speed is not impaired by switching, and independent records are available. The instrument is said to be responsive to changes in combustibles of 0.05 percent and to be accurate to within



0.25 percent. It is being utilized for the precise control of furnace atmospheres and chemical processes, as well as for measuring the combustible content of gases in petroleum, metallurgical, automotive, and chemical industries.

Here's a neat container for shops where glue and coatings of one kind or another are used intermittently. It's built of heavy aluminum and has two desirable features: a snugly fitting top that covers

both the contents and the brush to prevent evaporation and hardening, and a removable crossbar to wipe surplus material from the brush and upon which to hang it when not in use. The can comes in 1- and 2-quart sizes and is made by Kindt-Collins Company, Cleveland 11, Ohio.

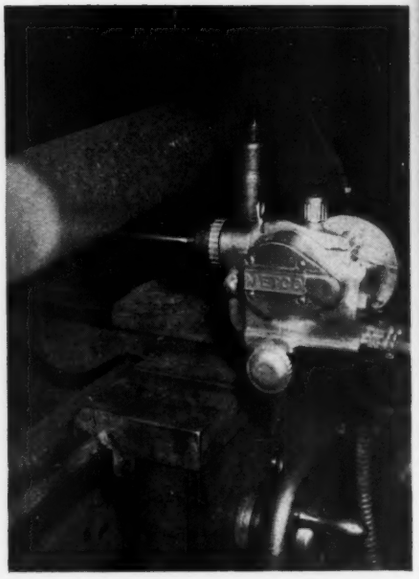
Metalsorter is the name of a machine developed by the Farmers Engineering & Manufacturing Company for the purpose of identifying ferrous and nonferrous metals and alloys. The equipment is portable and operates on the triboelectric principle. A known or acceptable specimen is rubbed against one of unknown or doubtful character, and if there is a metallurgical or chemical dissimilarity between the two, a minute electric current is generated and registered on the calibrated scale of an indicator. If pieces are alike in composition no current is recorded. The machine is plugged into a lighting circuit and is equipped with a control unit connected by a multiple-conductor cable to a reciprocating fixture provided with a specimen-holding chuck and a flexible lead to connect it with the metal to be identified. The Metalsorter is designed to test finished products of well-nigh any shape.

As the result of war experience with equipment used in cooling highly concentrated sulphuric acid from 475° to 175°F. and lower in making high explosives, the National Radiator Company has developed a U-cast hairpin cooler element for peacetime application. The new unit is said to be suitable for cooling any liquid, but is especially adapted for service in connection with acids or strong alkalies. The sections are cast of gray iron, which is highly resistant to both the solutions and their fumes. The coolant is usually water and is passed through the element, which is submerged in the bath. According to the manufacturer, the coils that were formerly used in the acid-cooling vats of munitions makers had to be completely replaced at least every three months, while the new elements in the same tanks show no signs of corrosion either above or below the liquid level after months of service. The cooling capacity of the latter is said to be as satisfactory as that of the displaced unit.

Spilled acid, oil, grease, chemicals, and other liquids can be readily soaked up, it is claimed, by Super-Absorbit, a mineral product that absorbs 392 percent of its weight in water and 315 percent in oil. It is a very light noninflammable, dielectric material and is offered by Alexite Engineering Company.

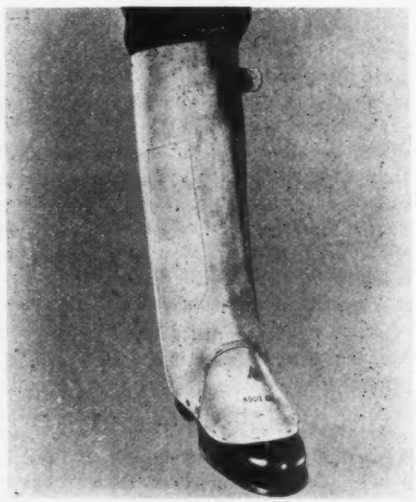
Having passed the test on fighting ships for which it was designed, the 50-watt shock-absorbing incandescent bulb of the General Electric Company is available for such services as lighting machinery and areas exposed to vibration or sudden impacts. The lamp differs from the ordinary type in that a thick rubber band fits tightly around the neck from the screw base to the glass, which it overlaps just a little. This simple cushion, we are told, enables the light to withstand shocks of 2000 foot-pounds and more.

A metallizing gun designed for mechanical mounting and continuous operation, in contrast to the hand-held types previously available for intermittent use, has been introduced by The Metallizing Engineering Company. It is called the Metco Type Y. As weight is not important in a mounted machine, the new model has been made larger and heavier than hand-held guns, with a consequent gain in sturdiness and durability of its wearing parts. A ⅜-inch wire is fed to the nozzle, where melting temperature is provided by gas under pressure. A built-in force-feed pump supplies bearings with lubrication regardless of the machine's operating position. The accompanying illustration shows one of the guns mounted for spraying metal on a rotating shaft.



By welding short pieces of 3-inch-diameter, cold-rolled steel to the treds of a crawler tractor, the contractors constructing the Horseshoe Dam on the Verde River in Arizona converted the vehicle into a tamper. It was utilized to compact layers of earth fill in building cut-off walls in the bed of the stream which, at the dam site, flows through a narrow gorge that precluded the use of a standard sheep's-foot roller with its large turning radius. With the improvised equipment it was possible to work to within a few inches of the walls and to reach all but the most inaccessible corners. Those sections were finished by pneumatic hand tampers.

All of us who have walked through a moving train know how hard it is to open the heavy doors between cars. We hear that something has been done about it—that a mechanism has been devised that will magically do the work for us. The power by which it is actuated is compressed air, which is drawn from the same source that supplies the air-brake system with which every train is provided. The equipment was developed by the National Pneumatic Company and is a combination opener and closer that functions automatically as soon as anyone comes along and gives a door not much more than a light touch.



SAFETY FIRST

Complete leg protection from instep to knee is offered by this new legging designed by the American Optical Company. It is intended for foundrymen and other industrial workers and is made of asbestos, fire-resistant duck, or chrome leather specially tanned to resist heat and splashes of molten metal. The flare over the instep is of chrome leather. A shorter variety or spat is available for instep and ankle protection.